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Combustion Testing of Ceramic Coal-Water (C.W.F.) Atomizers in Unit No.1 Chatham New Brunswick Generating Station

Final Report N.R.C. Burner Demonstration

Project Manager

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The New Brunswick Electric
Power Commission

Energy Mines and
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NRC BURNER DEMONSTRATION
AT
N.B. POWER'S CHATHAM T.G. STATION

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NRC BURNER DEMONSTRATION
AT
N.B. POWER'S CHATHAM T.G. STATION

EXECUTIVE SUMMARY

The objective of this demonstration was to establish the performance of the new and larger ceramic CWF gun/atomizers developed by the National Research Council of Canada (NRC) while burning Carbogel CWF produced by CBDC in Nova Scotia, in N.B. Power's Chatham Unit No. 1 Boiler.

With the agreement of the Scientific Authority, and under their direction, modifications were carried to one burner register throat in N.B. Power's Front Fired Boiler. These modifications were designed to provide more control over the secondary combustion air flow, to in turn improve control of the coal-water fuel (CWF) flame.

The new NRC gun/atomizer was first tested in June 1985, and although good atomization and combustion were achieved, it's capability fell short of the expected 40,000,000 BTU/hr. The results of this test were used by NRC to build a scaled-up gun/atomizer with capacity 55,000,000 BTU/hr., the size required for the Charlottetown project. This larger gun/atomizer was first tested in the fall of 1985.

In July 1985, testing was carried out of a new swirler which had been designed to provide improved recirculation of the combustion air in the original Forney burner.

While NRC were developing their scaled-up gun/atomizer problems were experienced with the coal water fuel in the plant storage bunker. This required the immediate incineration of the fuel, and this was completed by mid August 1985. At this time the coal water fuel stored in the three rail cars was still in good condition.

In late September 1985, the CWF in the three rail cars started to settle and had to be rehabilitated before it could be burnt. This rehabilitation was carried out between November 4, and 23, 1985 and resulted in bringing the fuel to a state where it could be burnt even though the quality varied widely.

On October 1, 1985, the new scaled-up NRC gun/atomizer arrived at the Chatham plant and was given a short test with re-mixed CWF. The testing was halted on October 3, 1985 and did not resume until early November 1985 because of commitments to the OX-CE fuel demonstration program.

Successful testing of the scaled-up NRC gun/atomizer was completed on November 6, 1985, using the rehabilitated CWF.

From November 26, 1985 until February 17, 1986, no test work was carried out under this project. During this time, with the approval of the Scientific Authority, a baghouse was purchased and installed on the Unit No. 1 boiler, at no cost to the project. The purpose of this expanded program was to test the performance of the filter bag fabrics and to establish an operating procedure for a baghouse when burning either coal-water fuel, or a combination of coal-water fuel and heavy fuel oil.

During the baghouse (Dust Collector) test program from February 18 to March 7, 1986, approximately 200 tons of new CWF were burnt using two larger NRC, CWF gun/atomizers. One in the modified burner throat, and the second in the original burner in which only the swirler had been changed.

This provided a good comparison between the two burners, and clearly showed the gun/atomizer in the modified burner throat worked the better of the two. In this burner a good stable fire was established with continuous firing, first using air atomization, and later with steam atomization.

Efficiency tests were conducted with the two large NRC gun/atomizers using the following three modes of operation:

1) CWF with air atomization
2) CWF with steam atomization
3) Heavy fuel oil with steam atomization

The NRC gun/atomizer in the EMR modified burner gave by far the best results, and at the end of the demonstration was in continuous operation for over 26 hours of which 18 hours were with steam atomization. This was the longest continuous time in operation recorded for any of the atomizers tested during any of the CWF tests conducted at the Chatham Plant.

This demonstration clearly showed that N.R.C. had developed both: a gun/atomizer that produces a good stable flame while burning C.W.F. of varying quality, and the ability to scale-up the capacity of their gun and atomizer. In addition, E.M.R. have developed the ability to design a burner register that is compatible with the N.R.C. gun/atomizer.

N.B. Power's personnel obtained much more operating experience with CWF burners, and in handling both good and problem coal-water fuels.

From the promising results of this demonstration it is felt the N.R.C. gun/atomizers are now ready to be installed in a larger boiler as part of the continuing coal-water fuel and CWF burner development.

CNR DEMONSTRATION DE BRÛLEURS
À
LA CENTRALE ÉLECTRIQUE D'ÉNERGIE N.B.

SOMMAIRE EXECUTIF

Le but de cette démonstration était d'établir la performance des nouveau, et plus grand, fusils/atomiseurs en céramique, de mélange charbon-eau qui ont été developper par le Conseil National de Recherche du Canada (CNR), pendant la combustion du mélange charbon-eau Carbogel, produit par la Corporation du Développement du Cap Breton, dans l'Unité N°1 de la Centrale de Chatham d'Énergie N.B.

Avec l'approbation, et sous la direction, de l'Autorité Scientifique, la gorge de repérage d'un brûleur de la chaudière a chauffage frontale d'Énergie N.B. a été modifié dans le but de fournir un contrôle plus étroit du passage de l'air de combustion secondaire, afin d'améliorer le contrôle de la flamme du combustible charbon-eau.

Le premier essai du nouveau fusil/atomiseur du CNR a eu lieu en juin 1985. L'atomisation et la combustion étaient bonnes, mais la capacité n'a pas atteinte le niveau attendu de 40,000,000 Btu/hre. Le CNR s'est servi des resultats de cet essai pour construir un fusil/atomiseur agrandi dont la capacité est de 55,000,000 Btu/hre., la valeur nécessaire au project de Charlottetown. Le premier essai de ce fusil/atomiseur a eu lieu dans l'automne de 1985.

Des essai d'un nouveau tourbilloneur, conçu pour améliorer la recirculation de l'air de combustion dans le brûleur Forney original, ont eu lieu en juillet 1985.

Pendant que le CNR développaient leur fusil/atomiseur agrandi, des problèmes se présentaient avec l'entrepôsage du combustible charbon-eau dans le réservoir de la centrale. Ceci exigait la combustion immédiat du combustible, un fait accompli en mi-août, 1985. Entre-temps le combustible charbon-eau entrepôser dans trois voitures de train étaient toujours en bonne condition.

Vers la fin de septembre, 1985, le combustible carbon-eau commencait à s'établir au fond des voitures de train, nécessitant sa réhabilitation avant de pouvoir être combuster; un fait qui a eu prit entre le 4 et le 23 novembre, 1985 et qui resultat à remettre le combustible dans un état brûlable, même si sa qualité variait largement.

Le nouveau fusil/atomiseur agrandi de CNR a arrivé à la Centrale de Chatham le premier octobre, 1985, et a été mit à une courte essai avec le combustible charbon-eau re-mélangé. Les essais ont arrêté le 3 octobre, 1985, et, comme resultat de commettement antérior au programme de demonstration du combustible OX-CE, n'a pas reprit jusqu'au commencement de novembre, 1985.

Les essai du fusil/atomiseur agrandi du CNR ont été compléter avec succès, en se servant du combustible charbon-eau réhabiliter, le 6 novembre, 1985.

Pendant une pause dans les essais sous ce projet entre le 26 novembre, 1985 et le 17 février, 1986, avec l'approbation de l'Autorité Scientifique et sans coût au projet, un collecteur de poussiére a été achetée et installée sur la chaudière de l'Unité N°1.

Presque 200 tonnes de nouveau combustible charbon-eau ont été combustées pendant les épreuves du collecteur de poussiére qui ont pris place le 18 fèvrier jusqu'au 7 mars, 1986. Ces épreuves se sont servis de deux fusils/atomiseurs agrandi de combustible charbon-eau du CNR; un située dans le brûleur auquel la gorge de repérage a été modifiée, et l'autre dans le brûleur Forney original sur quel seulement le tourbilloneur avait été changée.

Ceci a servie comme une bonne comparaison des deux brûleurs et a clairement démontrée que le brûleur avec la gorge de repérage modifier marchait le meilleur des deux, avant établie une bonne flamme stable sous un feu continu, premièrement avec l'atomisation à l'air et après à la vapeur.

Des épreuves d'éfficacité ont été conduit sur les deux fusils/atomiseurs agrandi du CNR sous les trois mode d'opération suivante:

1) combustible charbon-eau avec atomisation à l'air;

2) combustible charbon-eau avec atomisation à la vapeur, et;

3) combustible mazout lourd avec atomisation à la vapeur.

Le fusil/atomiseur du CNR installée dans le brûleur modifée par EMR a donné sans doute les meilleurs resultats, et par la fin de la démonstration était en opération continu pour plus que 26 heures; 18 de ces heures avec atomisation à la vapeur. Ceci était le plus long temps d'opération continu qui à été attesté pour n'importe quel atomiseur mis à l'épreuve pendant les essais du combustible charbon-eau qui ont été conduit à la Centrale de Chatham.

Cette démonstration à mis à l'épreuve qu' N.R.C. a developpé une combinaison: fusil/atomiseur qui produit une bonne flambe stable en brûlant le combustible charbon-eau de qualité variable et la capacité d'augmenter la capacité de leur fusil et atomiseur. Aussi, E.M.R. ont developpé la méthode pour dessiner un brûleur régistre qui est compatible avec le fusil/atomiseur d'N.R.C.

Le personnel d'ènergie N.B. ont obtennu beaucoup plus d'expérience avec les brûleurs du combustible charbon-eau, et en se servant de bonnes et mauvaises qualités du combustible charbon-eau.

Avec les résultats prometteurs de cette démonstration, l'imprèssion est que les brûleurs/atomiseurs d'N.R.C. pourrait être installé dans une chaudière a plus grande capacité qui ferrait parti du développement continuelle du combustible charbon eau et le développement de ces brûleurs.

3.0 INTRODUCTION

The Department of Energy, Mines and Resources has identified coal-water fuels technology development as a priority. The potential for the fuel relates to oil substitution in boilers and furnaces not designed for conventional pulverized coal combustion. Under the special Atlantic Initiatives, funding is being provided to develop burners to burn coal-water fuel and to demonstrate the combustion performance of the fuel in the two utility boilers at Chatham, N.B. In its role of technology support to this demonstration, the Canada Centre for Minerals and Energy Technology (CANMET) has been involved in development of CWF burners through the Chatham Utility Boiler Demonstration Project.

The earlier demonstrations had shown that the burner performance and the short life of the atomizer tips were two of the weak points of the burner development. During these earlier tests, the National Research Council of Canada in Ottawa (NRC) had been involved with the development of Ceramic inserts for the atomizer tips. From this work NRC had designed and built their own C.W.F. gun and atomizer.

The objective of this demonstration was to show that the new N.R.C. gun/atomizer had both the required capacity of 40×10^6 BTU/hr (40.GJ/h and long operating life.

During this demonstration E.M.R. Canmet became involved in the burner register throat design, and the required capacity of the gun/atomizer was increased to 55×10^6 BTU/hr.

4.0 BACKGROUND

In April 1982, an agreement was signed between Energy Mines and Resources, N.B. Power and the Cape Breton Development Corporation which resulted in the construction of a coal-water fuel production plant at Sydney, Nova Scotia. The product from this plant was used for the testing of prototype coal-water fuel burners at N.B. Power's Chatham Generating Station in New Brunswick.

The results achieved from these tests have been encouraging and are supportive of the continued research and development of coal-water fuels as a substitute fuel in existing oil fired boilers.

Coal-water fuel and burner demonstrations are being investigated for oil fired utility boilers up to 100 MWe rating.

From the demonstrations that have been completed to date, it has been shown that the short life of the burner atomizer (tip of the gun), and poor burner performance are major problems. It was the objective of this demonstration to show that the new NRC, coal-water fuel gun/atomizer, had overcome these problems.

5.0 LIST OF PARTICIPANTS

- New Brunswick Electric Power Commission (provided the Plant)
- CANMET, Energy Research Laboratories, Department of Energy Mines and Resources Canada (the Scientific Authority)
- Cape Breton Development Corporation (coal-water fuel supply)
- National Research Council of Canada (provided gun/atomizers)
- Research and Productivity Council of New Brunswick, (fuel analysis)

6.0 WORK DESCRIPTION

6.1 The original work plan for this demonstration involved:

- the removal of the gun cooling tubes from all four of Unit No. 1 front fired burners
- the installation of new gun guide tubes in all four burners to accommodate the new NRC guns
- the installation of a new flow control and measurement station at the No. 4 burner
- relocation of the CWF, rail car unloading station because of construction of the No. 3 boiler
- the testing of the new NRC, coal-water fuel, gun/atomizer

6.2 The work plan expanded as the gun/atomizer demonstration progressed to include:

- building, by NRC, of two larger gun/atomizers
- the modification of both the No. 1 burner primary combustion air throat and secondary combustion air throat
- the water spray tests of these new burner throats
- the installation of a small CWF day tank, so that new CWF could be burnt while old or different CWF was in the main storage tank
- the installation of a dust collector (Baghouse) on the roof of the Unit No. 1 boiler house, to remove the particulate from the boiler flue gas. A separate report has been prepared covering the operation of this dust collector.
- the testing of the modified No. 1 burner throat and larger NRC gun with both steam atomization and air atomization.
- the efficiency testing of the Unit No. 1 boiler with both CWF and heavy fuel oil using the two new NRC guns.

7.0 SEQUENCE OF EVENTS

DATES		DETAILS OF EVENTS
April 1985	-	Preparation for NRC Test Program.
April 19/85	-	Carbogel, Coal-Water Fuel (CWF), left Sydney, N.S.
April 25/85	-	3 rail cars of CWF from Sydney arrived at the Chatham Plant.
May 13/85	-	NRC personnel on site in Chatham to start their burner test program.
May 14/85	-	Water spray test on new burner/atomizers.
May 15/85	- -	Further burner testing. NRC personnel left site.
May 31/85	-	Opacity meter installed and commissioned.
June 4/85	-	Reviewed the Unit No. 1, Burner No. 1 throat modifications requested by NRC.
June 5/85	-	Carbogel, CWF starting to settle in bunker.
June 7/85	-	Burner No. 1 throat modified so that the Primary and Secondary combustion air will mix before reaching the atomizer tip.
June 8/85	-	Water spray test on the modified No. 1 burner.
June 14/85	-	The shape of Burner No. 1, secondary air throat changed by the addition of extra refractory.
June 18/85	-	NRC personnel returned to Chatham to test the reshaped No. 1 burner.
	-	The large NRC gun/atomizer only had an output of 20×10^6 BTU - less than half the required capacity.
June 22/85	-	NRC personnel left Chatham.
July 3/85	-	EMR/NRC returned to Chatham to test a new deflector on the gun in the No. 1 modified burner, and to test a new primary air swirler in Burner No. 4.
July 5/85	-	Second shipment of 3 rail cars of carbogel (CWF) received from Sydney.
	-	EMR/NRC personnel left Chatham.

DATES		DETAILS OF EVENTS
July 8/85	- -	Project review meeting at NRC office in Ottawa. NRC will build a larger CWF gun/atomizer with a capacity of 55 x 10^6 BTU.
July 16/85	-	Carbogel (CWF) in the bunker is settling.
July 19/85	-	Stabilizer received and added to CWF in bunker.
July 22/85	-	Fuel sterilizer received and added to CWF in bunker.
July 30/85	-	More problems with the settling of the carbogel in the bunker.
Aug. 12/85	-	Unit No. 1 in service to burn up the CWF fuel (carbogel) in the bunker.
Aug. 16/85	-	All CWF in bunker burnt and piping flushed out.

From early August to late September, the new and larger N.R.C. gun/atomizer was being manufactured.

Sept. 25/85	-	The carbogel in the three rail cars was tested in Chatham and found to be in good condition.
Sept. 30/85	-	NRC arrived in Chatham to test their new larger gun.
Oct. 1/85	- - -	New NRC gun installed in Unit No. 1 boiler. A small amount of Carbogel fuel unloaded. The carbogel in the three rail cars was found to be starting to settle.
Oct. 2/85	-	Preliminary testing done on the new NRC gun/atomizer.
Oct. 3/85	- -	Unit No. 1 shut down because of a tube leak. NRC personnel left Chatham.
Nov. 4/85	-	Work started on rehabilitating the three rail cars of Carbogel fuel in Chatham, and getting ready for the retesting of the larger NRC-CWF guns.
Nov.5-21/85	-	Problems were experienced in obtaining the required fuel additives from CBDC in Sydney, N.S., and A.B. Carbogel in Sweden.

DATES	DETAILS OF EVENTS
Nov. 7/85	One rail car of remixed (but unstable) carbogel fuel unloaded.
	A small amount of fuel additive C-13 (stabilizer) which the Chatham Plant had on hand was added to the fuel.
Nov. 12/85	The one rail car of CWF had been recirculated in the bunker over the long weekend.
	Still no word from CBDC or A.B. Carbogel as to when the required chemical additives will be shipped to Chatham.
	The Unit No. 1 boiler developed a leak when it was being brought up to operating conditions.
	The NRC personnel arrived on site to start the test program.
Nov. 13/85	The NRC personnel left the Chatham Plant because once the boiler repair had been completed there would not have been sufficient time to do any testing that week.
Nov. 14/85	Unit No. 1 boiler repair completed.
Nov. 18/85	Unit No. 1 in-service burning the reworked CWF, with the original guns.
Nov. 19/85	The NRC personnel returned to the Chatham Plant.
Nov. 20/85	NRC gun/atomizer test started.
	The first rail car of reworked fuel was burnt by the evening. Good flames were obtained with the NRC guns/atomizers.
Nov. 21/85	The second car of partly reworked fuel was unloaded overnight.
	Good flames were obtained with both of the NRC guns.
	The C-13 stabilizer was added in the evening to the remaining fuel in the bunker.
Nov. 22/85	Poor fires with both the NRC and original guns, support ignition had to be used.
Nov. 23/85	The second rail car of fuel was burnt by late in the day.

DATES	DETAILS OF EVENTS
Nov. 24/85	- The third rail car of fuel, with all the fuel additives in it, unloaded overnight.
	- Poor fires with the NRC guns and support ignition had to be used.
Nov. 25/85	- Unit No. 1 was in-service until 1:50 a.m. Tuesday, Nov. 25 to burn the remaining fuel, and to obtain the maximum number of operating hours on the NRC atomizers.
	- As this third car of reworked fuel was burnt, the fires started to improve. This was due to the fuel improving with age and receiving more mixing.
	- This completed this phase of the NRC test program.
Jan. 1986	- Preparation to resume NRC test program.
	- NRC started manufacturing a second large CWF gun/atomizer.
Jan. 8 to Feb. 14/86	- Installation of the dust collector (baghouse) on the roof of the Unit No. 1 boilerhouse.
Feb. 17/86	- No. 1 Burner throat was modified over the weekend, and combustion air flow control collars installed on the primary combustion air sleeve dampers in all four burners.
Feb. 18/86	- When the Unit No. 1 boiler was brought up to pressure a problem developed with a feed water valve and the unit had to be shut down before any extensive testing could be undertaken of the new NRC gun/atomizer and EMR modified burner.
Feb. 19/86	- The Unit No. 1 Boiler was back in service and all day was spent trying to optimumize the NRC coal water fuel gun-atomizers to the new C.W.F.
Feb. 20/86	- Shortly after the turbine had been put into service the vacuum in the condenser was lost and the rest of the day was spent trying to locate the leak in the vacuum system.
	- In the evening the boiler and turbine were in-service for a short time to assist in locating the vacuum problem, one leak was found and repaired over night.

Feb. 21/86 - Early in the morning the turbine was again put into service but the required vacuum could not be obtained.

- It was late in the day before the problem was finally overcome and the unit was put in service, by this time the efficiency test crew had left the site. (Friday evening).

- In the evening the NRC crew did some more work to optimumize the settings on their gun-atomizers to suit the new C.W.F.

Feb. 22/86 - The unit was out of service on the Saturday to give the crews a rest.

Feb. 23/86 - The NRC and EMR personnel together with N.B. Power's crew worked to further modify the collars on the primary combustion air sleeve dampers and to install a new primary air throat in the No. 1 burner throat.

Feb. 24/86 - All day was spent trying to improve the fires obtained with the two larger NRC gun-atomizers and the new C.W.F. The problem was the viscosity of the C.W.F. was continuously falling while it was being pumped through the fuel supply and recirculating system.

- By late in the evening it was felt the C.W.F. fires were as good as could be obtained with the changing coal-water fuel, therefore arrangements were made to have the efficiency testing crew return to Chatham the next day.

Feb. 25/86 - The following three tests were conducted:

1. CWF with air atomization.
2. CWF with steam atomization.
3. NRC gun burning Bunker "C" oil with steam atomization,

Feb. 26/86 - As very little CWF was left no more testing could be undertaken until additional CWF had been received.

March 4/86 - Preparation were made to do further testing of the EMR modifications to the No. 1 Burner.

- The first truck load of the second batch of CWF arrived in Chatham.

- A larger sleeve was installed in the No. 1 burner throat.

March 5/86 - The test program was resumed but the unit could not be put on-line because a seal had failed on the boiler feed pump.

- The seal was repaired and shortly after the unit was on-line it had to be shut down again because of a cooling water leak in the condenser.

- The maintenance crew worked all night to repair the condenser leak.

March 6/86 - By mid-morning the unit was on-line.

- No. 1 Burner was in service burning C.W.F. with air atomization, and a good, bright bushy flame was obtained.

- Once stable fires had been obtained in the No. 1 burner, efforts were made to improve the CWF flame in burner No. 4.

- Late in the afternoon the No. 1 gun had to be removed because the flame had deteriorated. It was found a piece of rubber (possibly from the fuel pump stator) had plugged the atomizer tip. The NRC gun was returned to service and a good stable fire obtained again.

- By this time the No. 1 gun-atomizer had been in service for eight hours with air atomization and no support ignition.

- The atomization medium was changed from air to steam. This was accomplished without any problem.

- At midnight the No. 4 gun burning CWF was removed from service, and the boiler was run overnight with the No. 1 gun burning C.W.F. at full load with steam atomization, and oil guns at part load in burner Nos. 2 and 3, to maintain the required heat level in the furnace area of the boiler.

March 7/86 - The No. 1 burner ran all night without any problems burning CWF with steam atomization.

- In the morning the No. 4 burner was returned to service with air atomization.

- Stable fires could not be obtained with the no. 4 burner gun when using steam atomization.

- Both burners No. 1 and No. 4 were kept in service until all the coal water fuel had been consumed.

- No. 1 burner remained stable until the end, where as the No. 4 burner became un-stable as the last of the fuel was burnt.

- At this time the No. 1 burner had been in continuous service for 26 hours. Eight hours burning CWF with air atomization, plus 18 hours burning CWF with steam atomization, without any support ignition. This was the longest time any CWF gun had been run at the Chatham Plant with steam atomization.

- This concluded the on-site testing at the Chatham Plant under this phase of the contract.

March 12/86 - A meeting was held at NRC's office in Ottawa to review the work that been accomplished, and plan future testing.

8.0 DESCRIPTION OF THE C.W.F. BURNER ASSEMBLY

8.1 Original CWF Assembly

In the spring of 1983 the old oil burners were removed from the front wall of the Unit No. 1 boiler, and burners that had been designed to burn coal-water fuel were installed. These burner assemblies were larger than the oil burners so the burner ports in the front wall of the boiler had to be increased in size. This was done by replacing the five boiler water wall tubes between the right hand and left hand burner ports.

Figure 8.1 shows the original C.W.F. burner assembly, developed for the first CWF demonstration conducted between July 1983 and December 1984. The primary combustion air was introduced behind the swirler, mounted on the CWF burner gun guide tube. This gave a very long and tight flame as shown in figure 8.2. More shaping of the flame was done by the secondary combustion air, which was introduced outside of the primary throat. A swirler was also given to the secondary combustion air by the adjustable vanes.

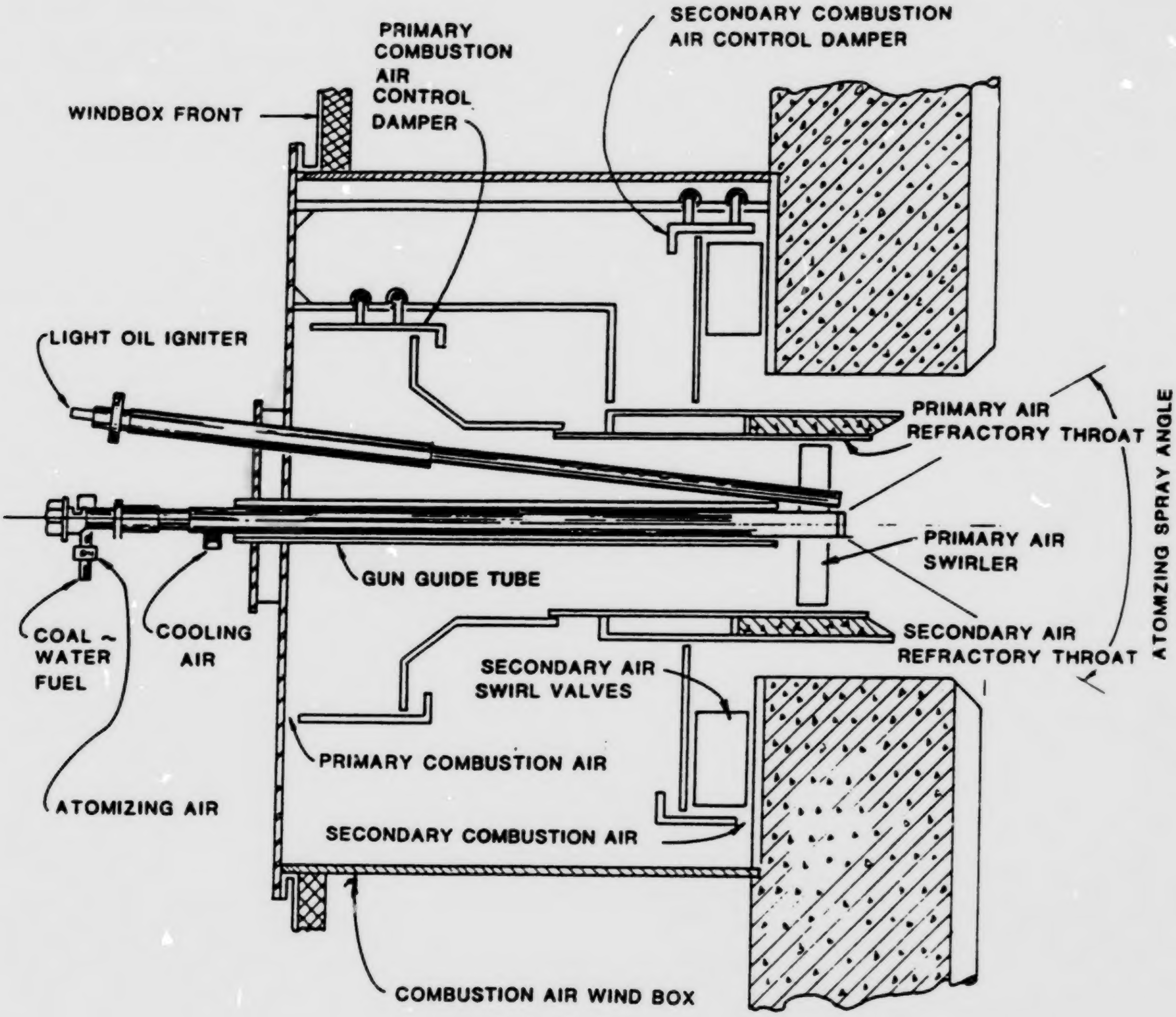

SECONDARY COMBUSTION AIR CONTROL DAMPER
PRIMARY COMBUSTION AIR CONTROL DAMPER
WINDBOX FRONT
LIGHT OIL IGNITER
PRIMARY AIR REFRACTORY THROAT
ATOMZING SPRAY ANGLE
PRIMARY AIR SWIRLER
GUN GUIDE TUBE
COAL ~ WATER FUEL
COOLING AIR
SECONDARY AIR REFRACTORY THROAT
SECONDARY AIR SWIRL VALVES
PRIMARY COMBUSTION AIR
ATOMIZING AIR
SECONDARY COMBUSTION AIR
COMBUSTION AIR WIND BOX

DIAGRAM OF THE ORIGINAL UNIT No.1
C.W.F. BURNERS

FIG. No.8.1

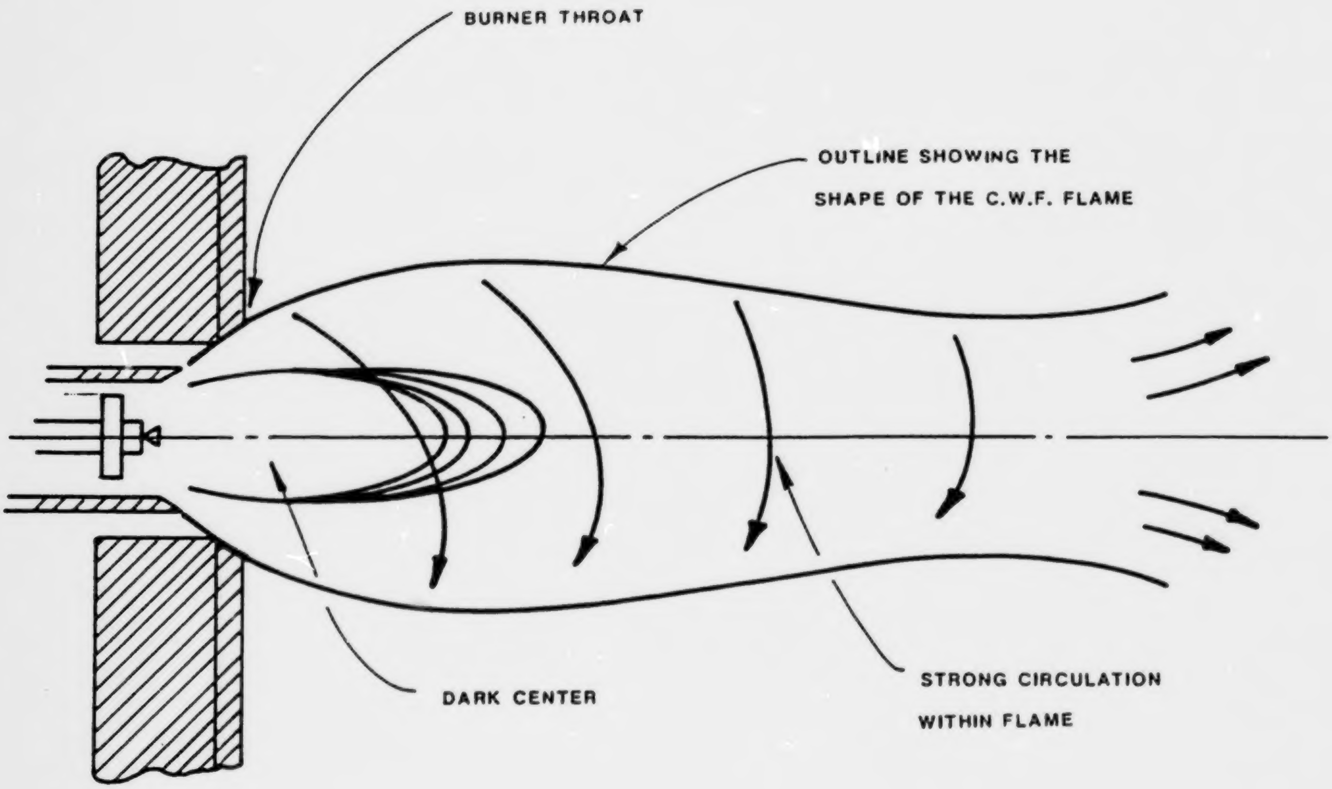

BURNER THROAT
OUTLINE SHOWING THE SHAPE OF THE C.W.F. FLAME
DARK CENTER
STRONG CIRCULATION WITHIN FLAME

DIAGRAM SHOWING THE SHAPE OF THE ORIGINAL C.W.F. FLAME IN THE UNIT No.1 FRONT FIRED BOILER

FIG. No.8.2

8.2 E.M.R. Modifications to the CWF Burner Throats

The size of the furnace area in a utility boiler is controlled by the fuel the boiler was designed to burn.

When comparing the firing of coal to fuel oil, a larger amount of coal must be burnt to produce an equal heat output to that of fuel oil. Therefore the boiler designed to burn coal will have a larger furnace area to handle the larger amount of fuel.

The long narrow flame, as shown in figure 8.2, was suitable for the Chatham Unit No. 1 boiler, as it had been designed to burn coal, whereas the next phase in the CWF burner development will be a CWF demonstration in one of the Charlottetown units. The boiler in this unit was originally designed to burn heavy fuel oil, and therefore has a small furnace area.

For this reason there were two objectives to be achieved with the burner throat modifications in the Chatham boiler.

i) a short bushy flame suitable for a smaller furnace area.

ii) more recirculation within the CWF flame to both improve the flame stability, and give more complete burn out of the fuel, which was closer to that of a fuel oil flame.

From the results of preliminary testing of the new NRC gun/atomizer it was felt improved control over the shaping of the CWF flame could be achieved if the secondary combustion air was introduced behind the atomizer.

The extra control was required because the original Chatham front fired burners would only produce a long, narrow flame which was not suitable for a fuel oil designed boiler.

From figure 8.3 it can be seen how the primary air throat was cut back so the secondary combustion air would be introduced behind the atomizer.

A water spray test was conducted to check the new fuel and combustion air flow patterns. Based upon the results of this test, the secondary combustion air throat was modified as also shown in figure 8.3. These modifications were made to further improve control over the shaping of the flame and recirculation within it. The recirculation within the flame was required to bring the hot gasses back into the centre of the flame to heat up the incoming fuel and thus improve combustion of the fuel.

The objective was to produce a short and bushy flame as shown in figure 8.4

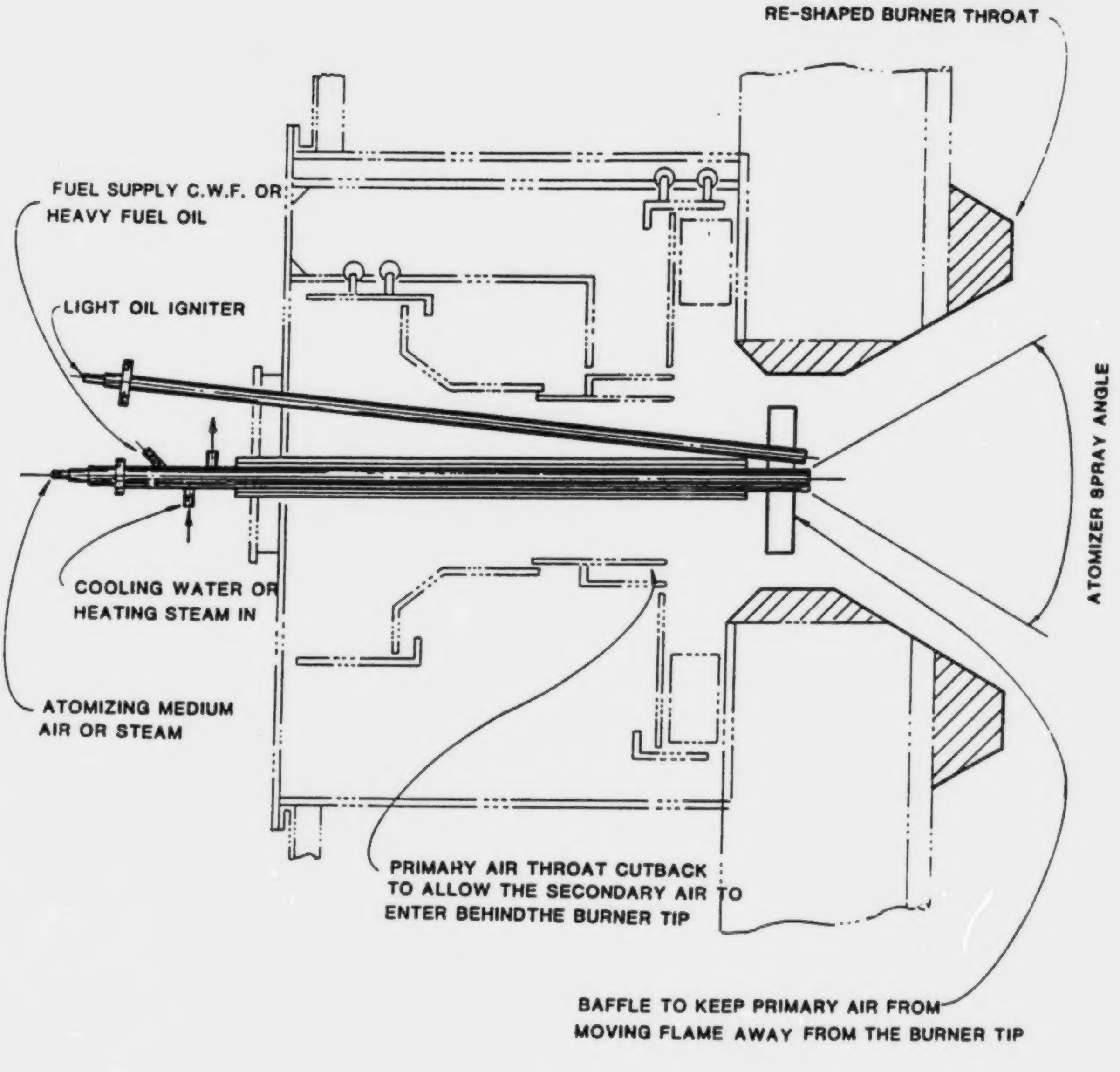

RE-SHAPED BURNER THROAT
FUEL SUPPLY C.W.F. OR HEAVY FUEL OIL
LIGHT OIL IGNITER
ATOMIZER SPRAY ANGLE
COOLING WATER OR HEATING STEAM IN
ATOMIZING MEDIUM AIR OR STEAM
PRIMARY AIR THROAT CUTBACK TO ALLOW THE SECONDARY AIR TO ENTER BEHINDTHE BURNER TIP
BAFFLE TO KEEP PRIMARY AIR FROM MOVING FLAME AWAY FROM THE BURNER TIP

DIAGRAM OF THE No.1 BURNER SHOWING
THE FIRST EMR MODIFICATIONS

FIG. No.8.3

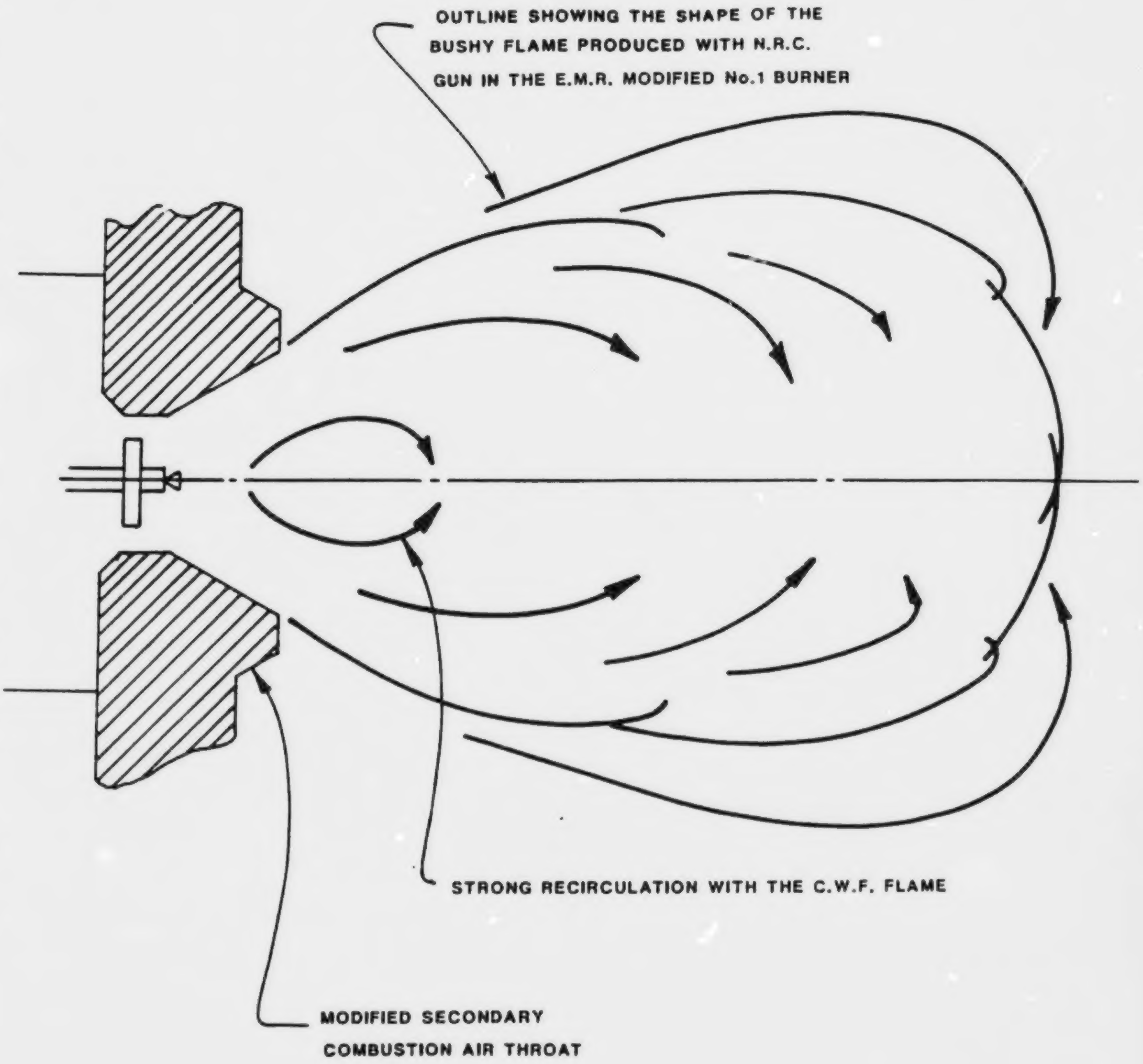

OUTLINE SHOWING THE SHAPE OF THE BUSHY FLAME PRODUCED WITH N.R.C. GUN IN THE E.M.R. MODIFIED No.1 BURNER
STRONG RECIRCULATION WITH THE C.W.F. FLAME
MODIFIED SECONDARY COMBUSTION AIR THROAT

DIAGRAM SHOWING THE SHAPE AND RECIRUCLATION WITHIN THE C.W.F. FLAME

FIG. No.8.4

8.3 Final E.M.R. Modifications

Burn tests and further water spray tests of the modified No. 1 burner resulted in further modifications to the primary air throat, as shown in figure 8.5.

This arrangement gave good stable fires with both air and steam atomization. The results of the burn in the modified No. 1 burner were compared to an identical NRC gun/atomizer in the original No. 4 burner in which only the primary combustion air swirler had been changed.

The NRC gun/atomizer in the E.M.R. modified No. 1 burner gave by far the better results, and the required stable and short bushy flame, as shown in figure 8.4, was achieved. More details of the results from the burn tests are given in section 12 and illustrated in figures 12.3 and 12.4.

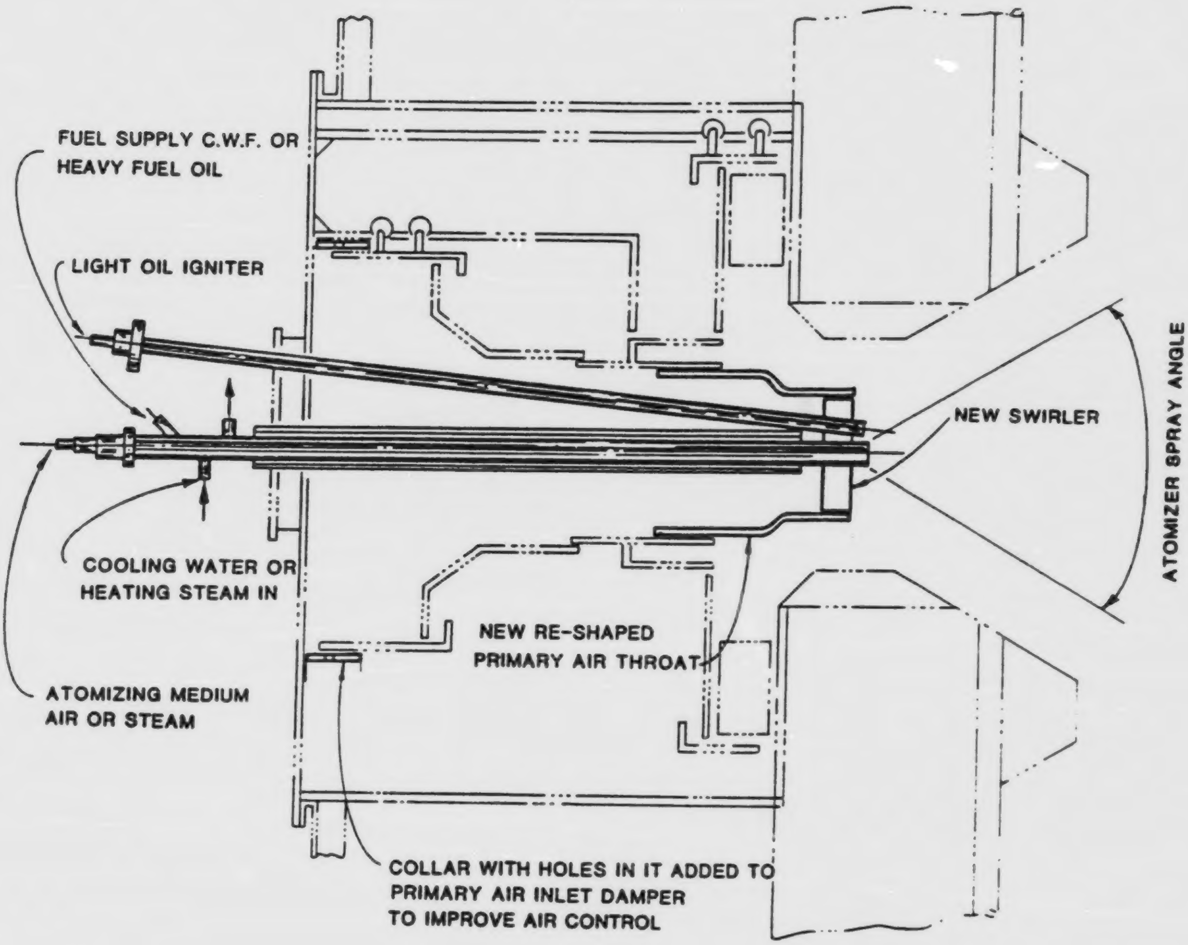

FUEL SUPPLY C.W.F. OR HEAVY FUEL OIL
LIGHT OIL IGNITER
COOLING WATER OR HEATING STEAM IN
ATOMIZING MEDIUM AIR OR STEAM
NEW SWIRLER
ATOMIZER SPRAY ANGLE
NEW RE-SHAPED PRIMARY AIR THROAT
COLLAR WITH HOLES IN IT ADDED TO PRIMARY AIR INLET DAMPER TO IMPROVE AIR CONTROL

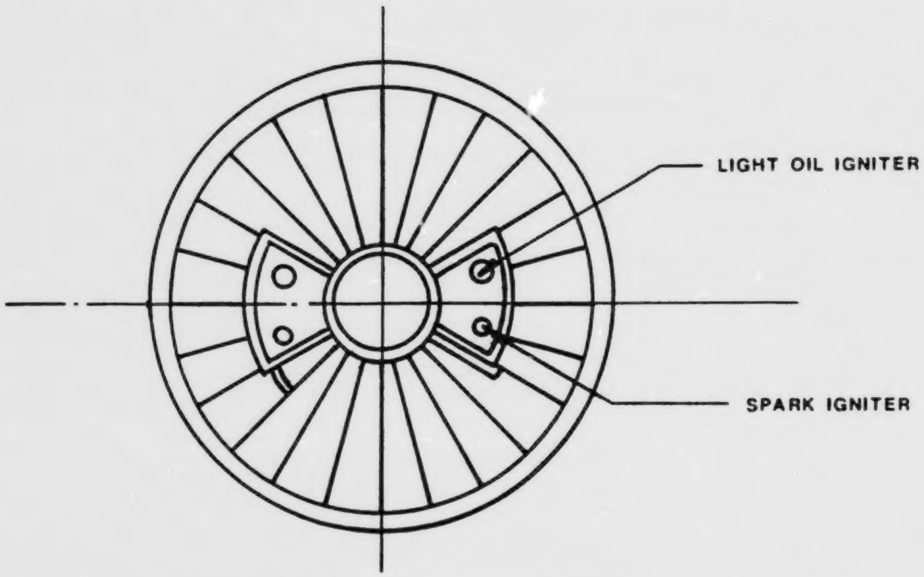
DIAGRAM OF THE No.1 BURNER SHOWING THE RE-SHAPED PRIMARY AIR THROAT AND MODIFIED PRIMARY AIR DAMPER

FIG. No.8.5

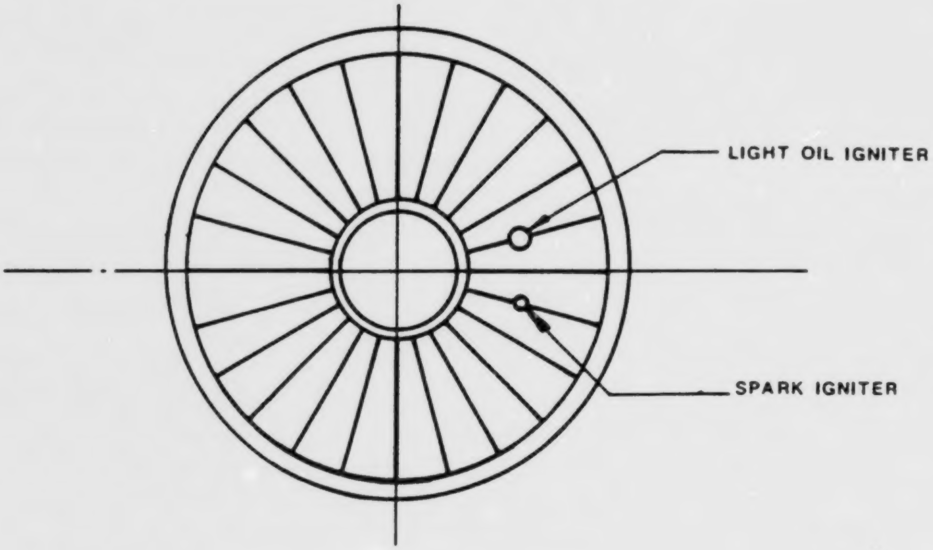
8.4 NRC Burner Modifications

N.R.C. also became involved in burner register modification, because during their early work with the original burners, it had been noted that there was poor distribution of the swirled primary combustion air, which resulted in an unstable flame. This was caused by the two large slots that had been built into the primary combustion air swirler (see fig. 8.6), to accommodate two light oil ignitor guns. During all the C.W.F. test programs in the Unit No. 1 Boiler, only one ignitor gun was ever required. For this reason one of the slots could be removed and it found the second could be replaced by a small hole.

This resulted in improved control over the primary combustion air, which in turn gave a more stable C.W.F. flame.


LIGHT OIL IGNITER
SPARK IGNITER

ORIGINAL PRIMARY COMBUSTION AIR SWIRLER


LIGHT OIL IGNITER
SPARK IGNITER

N.R.C. PRIMARY COMBUSTION AIR SWIRLER

FIG. No.8.6

9.0 DESCRIPTION OF THE NRC GUN/ATOMIZER

9.1 Original N.R.C. Gun/Atomizer

During the original C.W.F. burner demonstration in 1983/84, the National Research Council of Canada (NRC) became involved in the manufacturing of ceramic inserts for the burner atomizers. This was done to help improve the wear resistance and thereby extend the operating life of the burner atomizers.

From this earlier involvement N.R.C. designed and manufactured their own gun/atomizer with ceramic inserts.

As the burners tested during the earlier demonstrations had not proved entirely satisfactory, this N.R.C. atomizer demonstration was arranged as part of the further development of the commercialization of both coal-water fuels and burners. The first gun/atomizers built by NRC were sized to fit in to the original gun cooling tube (see fig. 8.1). The inside diameter of the cooling tube limited the size of the atomizer and resulted in a gun/atomizer which only had a capacity of 10 x 10^6 BTU/hr (10 GJ/h), however this was sufficient to demonstrate that the N.R.C. gun/atomizer gave a good and stable flame, and the adjustment within the atomizer worked well, permitting the space between atomizer tip and the orifice ring to be varied to compensate for changes in the coal-water fuel (see fig 9.2).

9.2 Medium Size NRC Gun/Atomizer

Based upon the successful results obtained with this small NRC gun/atomizer, a larger one was built with a predicted capacity equal to the original guns, 40 x 10^6 BTU/hr (40 GJ/h). A diagram of this NRC gun/atomizer is shown in figure 9.1 and the adjustable atomizer on figure 9.2. When comparing the NRC atomizer to the original one, (figure 9.3), it can be seen how the flow pattern through the NRC atomizer tip has been improved, with no abrupt changes in direction. Added to this the width of the fuel path through the atomizer which can be adjusted from the back of the gun while it is in service.

A jacket had been added around the gun to allow for heating or cooling the coal-water fuel.

This larger gun was accommodated in the burner assembly by removing the cooling tube and replacing it with a large guide tube.

When the gun/atomizer was tested it performed well but only had a capacity of 25 x 10^6 BTU/hr (25 GJ/h).

DIAGRAM OF THE N.R.C. GUN / ATOMIZER

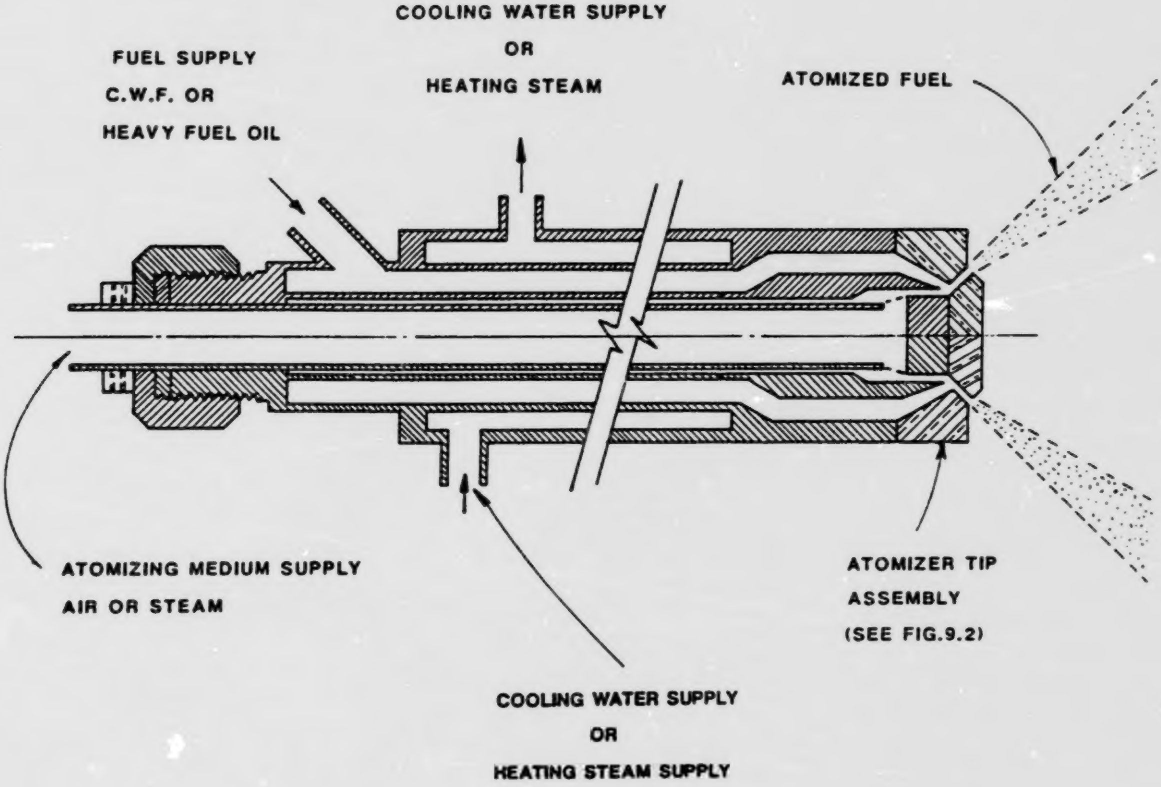
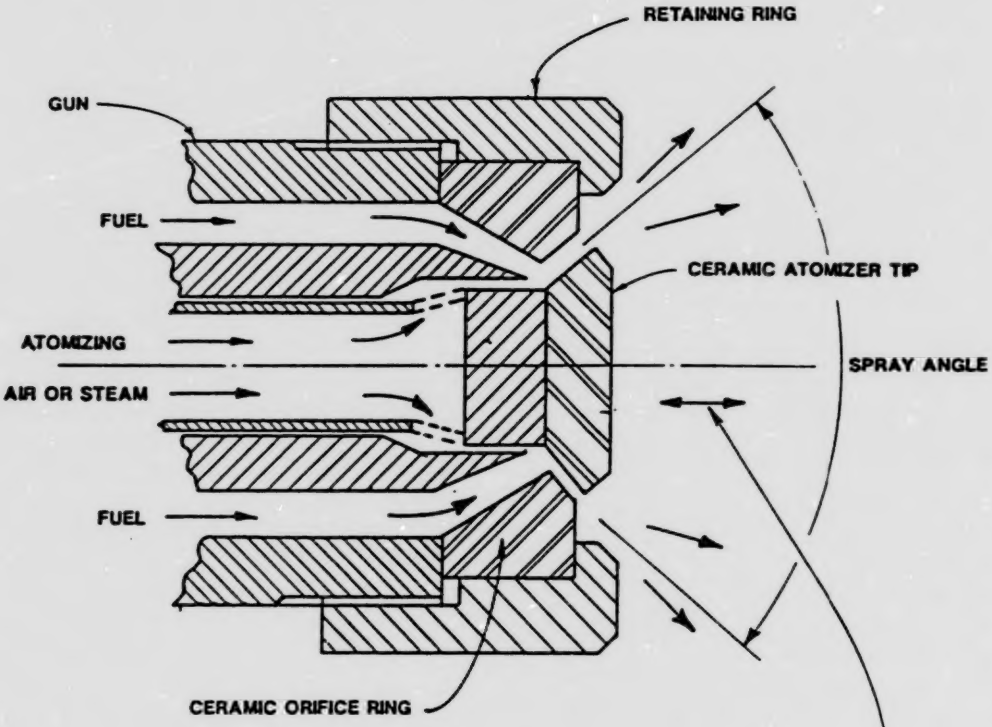

COOLING WATER SUPPLY
OR
HEATING STEAM
FUEL SUPPLY
C.W.F. OR
HEAVY FUEL OIL
ATOMIZED FUEL
ATOMIZING MEDIUM SUPPLY
AIR OR STEAM
ATOMIZER TIP
ASSEMBLY
(SEE FIG.9.2)
COOLING WATER SUPPLY
OR
HEATING STEAM SUPPLY

FIG. No.9.1

DIAGRAM OF THE N.R.C. ATOMIZER


RETAINING RING
GUN
FUEL
CERAMIC ATOMIZER TIP
ATOMIZING
AIR OR STEAM
SPRAY ANGLE
FUEL
CERAMIC ORIFICE RING

THE ATOMIZER TIP IS ADJUSTABLE (IN AND OUT)
SO THAT THE GAP BETWEEN THE TIP AND ORIFICE
RING CAN BE VARIED TO SUIT THE FUEL BEING BURNT

FIG. No. 9.2

DIAGRAM SHOWING THE ORIGINAL C.W.F. ATOMIZER

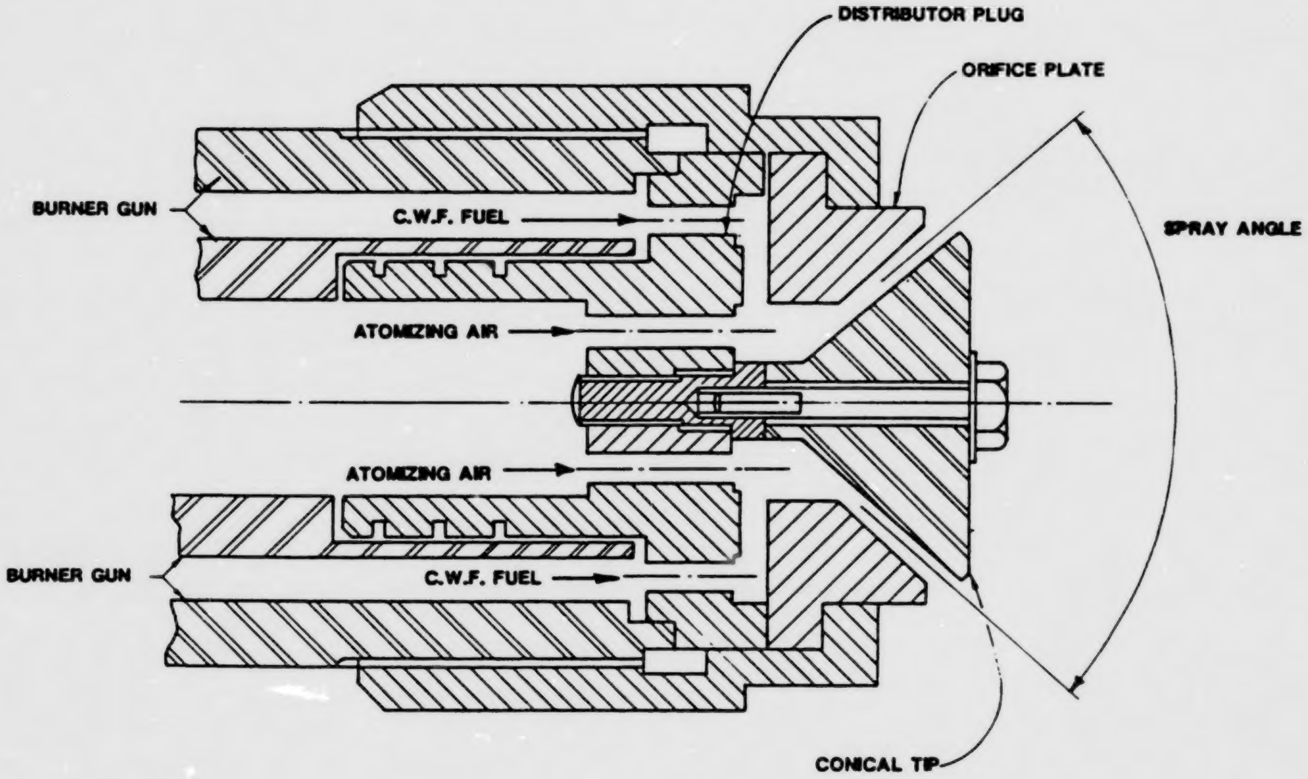

DISTRIBUTOR PLUG
ORIFICE PLATE
BURNER GUN
C.W.F. FUEL
SPRAY ANGLE
ATOMIZING AIR
ATOMIZING AIR
BURNER GUN
C.W.F. FUEL
CONICAL TIP

FIG. No.9.3

9.3 Large Size NRC Gun/Atomizer

N.R.C. rebuilt their gun for a second time with the capacity increased to 55 x 10^6 BTU/hr (55 GJ/h). The reason for this larger capacity, rather than the original target of 40 x 10^6 BTU/hr (40 GJ/h), was to match the size required for the next step in the CWF burner development. This being, the Charlottetown C.W.F. Demonstration, where 5 burners will be required in a 20 MWe unit, originally designed to burn only heavy fuel oil.

The manufacturing of the NRC gun/atomizers in three sizes gave NRC some very valuable information and experience at scaling up their gun/atomizers.

In this third and larger unit the same design was used with only the diameter increased in size.

This time the required capacity was achieved and the gun/atomizer performed well in the following three modes of operation.

- CWF with air atomization
- CWF with steam atomization
- Heavy fuel oil with steam atomization

In addition the burner could be switched ready between each mode of operation.

10.0 TEST PLAN

Initially it was planned, after installing and checking out the new NRC gun/atomizers, to simply repeat the same type of boiler efficiency tests at various loads on the unit, as had been conducted with the original burners in 1984. Once the new tests had been completed, the results would be compared to the ones obtained from the original tests. From these results it could be judged if the NRC burners had performed better than the original ones.

The boiler efficiency test had to be delayed a number of times, because initially the NRC gun/atomizers did not have the required capacity. Later further delays were encountered when the EMR burner throat modifications were added to the demonstration. These delays meant the coal-water fuel had to be kept in storage longer than planned. This resulted in the Carbogel CWF deteriorating which further added to the complications experienced during this demonstration.

It was not until March 1986 that a shortened efficiency test program was conducted, made up of the following three tests:

1. maximum obtainable load with the two large NRC guns in service, burning C.W.F. with air atomization.

2. the above test repeated with steam atomization.

3. again maximum obtainable load with the two large NRC guns in service burning heavy fuel oil with steam atomization.

After these tests had been completed, the NRC guns were kept in service until all the available C.W.F. had been consumed. This action was taken to establish the wear on the atomizers, and to test the new dust collector. A separate report has been prepared on the operation of the dust collector (baghouse).

A copy of the test data collection sheets, identifying all the readings that were planned to be taken and where the measuring points were located, are included in the appendix to this report.

UNIT No.1 BOILER SHOWING THE LOCATION OF THE TEST POINTS ON THE BOILER

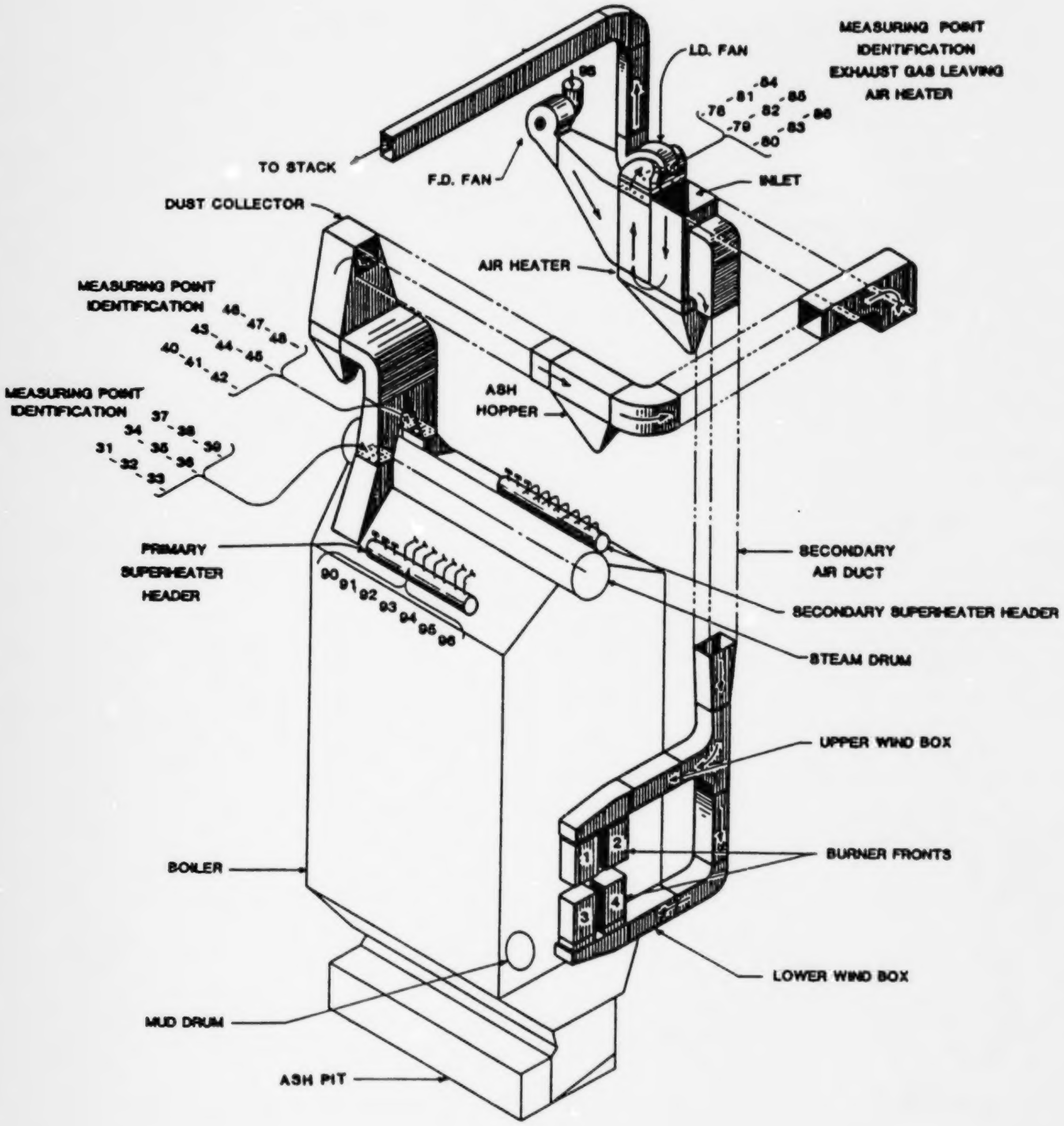

MEASURING POINT
IDENTIFICATION
EXHAUST GAS LEAVING
AIR HEATER
I.D. FAN
84
81
85
78
82
86
79
83
80
96
TO STACK
F.D. FAN
INLET
DUST COLLECTOR
AIR HEATER
MEASURING POINT
IDENTIFICATION
46
47
48
43
44
45
40
41
42
ASH
HOPPER
MEASURING POINT
IDENTIFICATION
37
34
38
31
35
39
32
36
33
PRIMARY
SUPERHEATER
HEADER
90
91
92
93
94
95
96
SECONDARY
AIR DUCT
SECONDARY SUPERHEATER HEADER
STEAM DRUM
UPPER WIND BOX
1
2
3
4
BURNER FRONTS
BOILER
LOWER WIND BOX
MUD DRUM
ASH PIT

FIG. No.10.1

11.0 ACTUAL TEST PROGRAM

11.1 May 13 to 16, 1985

This was the first site testing of the small NRC gun/atomizer under this new demonstration program. The time was initially spent setting up the NRC equipment, and conducting some preliminary flow measurements to establish the heat output of the NRC gun/atomizer. This was done so that the small NRC gun could be scaled up to the size required for the Chatham Unit No. 1 boiler. The prototype N.R.C. gun/atomizer was limited in size by the cooling tube in the original burner into which it had to fit.

The firing conducted at that time showed improvements could be made in two areas:

- The removal of the two large slotts in the original burner swirlers, which accommodated two light-oil ignitor guns.

  This could be done because it had been found only one light-oil ignitor gun was required, and a small hole could be used for the remaining ignitor gun.

  It was felt these two large slotts were having an adverse effect on the swirl of the primary combustion air. These modifications are covered in section 8.4 of this report; NRC burner modifications.

- The bushy/short flame required for boilers originally designed for oil firing could be better obtained if the primary combustion air throat was cut back to allow the secondary combustion air to enter behind the burner atomizer (see figure 8.3). These modifications are covered in section 8.2; E.M.R. modifications to the C.W.F. burner throats.

11.2 June 7 to 14, 1985

A representative from EMR was in Chatham to witness the modification of burner No. 1, primary air throat. It was cut back as shown in figure 8.3. Once the burner modification had been completed, water spray tests were conducted to determine if the combustion air and fuel flow patterns had been improved.

These tests showed that further improvements could be achieved if the secondary combustion air throat was reshaped.

The refractory modifications were undertaken the week of June 10 to 14, 1985 and are shown on figure 8.3.

11.3 June 17 to 22, 1985

The refractory work to reshape the No. 1 burner throat had been completed the week before, and it had been air dried over the weekend.

The new and larger NRC gun/atomizer was tested in burner No. 1 because a problem had developed with the atomizing steam supply to the No. 4 burner, on which the NRC personnel had installed their monitoring equipment and new swirler.

These tests showed that the control over the shaping and re-circulation within the coal-water fuel flame in the No. 1 burner had been improved.

The capacity of the new NRC gun/atomizer was measured, and it was found that the heat output was only 20 x 10^6 BTU/hr (20 GJ/h) and not the required 40 x 10^6 BTU/hr (40 GJ/h).

Despite the reduced capacity of the NRC gun/atomizer, it performed well, and atomizer tips with various spray angles were tested.

The NRC gun/atomizer ran successfully with steam atomization, and no plugging was experienced as had been encountered with the original CWF guns in the No. 1 boiler.

The opacity of the flue gas from the boiler stack was monitored and problems were encountered in keeping the opacity down to the required level.

From these test burns, it was concluded that a larger NRC gun/atomizer would be built, and the target capacity would be increased to 55 x 10^6 BTU/hr (55 GJ/h).

This was the capacity required for the burners in the Charlottetown boiler, that was to be tested after completion of this Chatham demonstration. This was the next step in the development and commercialization of coal-water fuels and burners.

Also, more development work would be undertaken on the redesign of the No. 1 burner combustion air flow patterns.

11.4 July 2 to 5, 1985

The new and larger NRC gun/atomizer was not scheduled to be completed until late August 1985, so this site test was entirely devoted to doing more testing of the EMR burner modifications, in conjunction with the medium size NRC gun (20 x 10^6 BTU/hr).

This gave the EMR burner designer more operating experience to assist with improving their burner. A bluff body (deflector) was installed on the end of the gun to prevent the primary combustion air from pushing the C.W.F. flame away from the atomizer tip. The bluff body had adjustable holes in it. The test had to be terminated when these holes became to far opened, which allowed the primary combustion air to push the CWF flame away from the atomizer tip. This resulted in unstable firing.

11.5 September 30 to October 3, 1985

When the new NRC gun/atomizer was delivered to the Chatham Plant for testing in the unit No. 1 boiler the main CWF storage tank in the plant had "OXCE" coal-water fuel in it. This "OXCE" fuel was being used for a separate program, that was running concurrently with NRC burner demonstration. Therefore a small fuel day tank was installed adjacent to the Unit No. 1 boiler, so the CWF for the NRC demonstration could be fed directly into the NRC metering pump supplying fuel to the No. 4 burner.

This setup was installed so that the new and larger (55×10^6 BTU/hr) NRC gun/atomizer could be checked out.

The new NRC gun/atomizer showed that it was capable of a much higher heat output than the two earlier guns. The demonstration had to be curtailed because of a boiler tube leak.

11.6 November 12 to 13, 1985

The Carbogel CWF for this demonstration had been stored in three rail cars all the summer, while EMR developed their burner modifications, and NRC rebuilt their gun so that it would have the required capacity.

During this time, the fuel had remained stable until late September 1985 when the coal started to settle out of the fuel. NB Power spent some time trying to rework this settled fuel (this is covered in more detail in section 13 of this report) and had sufficient fuel ready so that NRC could return to Chatham and undertake more testing of their large gun. Shortly after their return the unit No. 1 boiler developed a second tube leak, and no testing could be undertaken.

11.7 November 19 to 25, 1986

This test burn was started with the original CWF guns in service burning the coal-water fuel which had been reworked by NB Power's plant personnel.

Shortly after the start of the test burn, the NRC personnel returned to the Chatham Plant to do further testing of their large gun.

This resulted in a good comparison being obtained between the new large NRC gun/atomizer and the original CWF gun/atomizer from the 1983/84 demonstration.

When the original CWF guns were in service, the stack opacity reading was 60%, and this reading dropped to the 30-35% range when the large NRC gun was put into service. This opacity was further reduced to an acceptable level by running the unit No. 2 boiler fans. (See section 14 - Environmental, for a discussion on reducing opacity.)

During this period, the remaining three rail cars of Carbogel CWF (200 tons) were reworked by the addition of new fuel additives, and mixing the CWF and additives with air lances.

This proved to be an excellent test of the three NRC gun/atomizers because the three rail cars of settled Carbogel fuel were rehabilitated separately using different methods. This resulted in the NRC gun/atomizers being tested with fuels of different qualities.

The three NRC gun/atomizers received the following tests:

- The small CWF gun/atomizer, burning heavy fuel oil. This unit was judged to have a better oil flame than the oil guns supplied with the original burners.

- The medium size CWF gun/atomizer, which NRC had modified since their earlier testing at the Chatham Station. This gun was run at 20 X 10^6 BTU/hr and was reported to have the best CFM flame seen during all the Chatham CWF burns.

- The new large CWF gun/atomizer which was run at various loads, between 40 x 10^6 and 56 x 10^6 BTU/hr. The opacity from the No. 1 boiler was reduced by 50% when the original CWF guns were replaced by this gun/atomizer.

This concluded the burner development work in the 1985 demonstration but based upon the favourable results obtained with the NRC guns, while burning the rehabilitated Carbogel CWF, more burner testing was planned for early 1986 to be conducted while the new Baghouse was being evaluated on the Chatham unit No. 1 boiler.

11.8 February 17 to 21, 1986

During the three months since the previous CWF burn at the Chatham Plant, a new baghouse had been obtained and installed in the unit No. 1 boiler flue gas system, and NRC had built a second large gun/atomizer.

Very little burner testing could be done during this week because shortly after start-up of the Unit a problem developed with the turbine condenser. The vacuum was lost in the condenser and it took some time to locate the problem and correct it.

11.9 February 24 to 25, 1986

Two hundred tons of new Carbogel CWF had been purchased for this burner/baghouse demonstration. The CWF fuel was received in two shipments of approximately 100 tons each, with the fuel being transported by road tanker, instead of rail tank cars as were used on the earlier demonstrations.

Due to this, the system was only half full of fuel which subjected the CWF to more frequent recirculation. This, in turn, seemed to have an adverse effect on the CWF, as after being on site for about one week, its viscosity started to drop rapidly while the moisture content remained constant.

This resulted in poor CWF firing, and the good results which had been obtained with the rehabilitated fuel during the November 1985 burns could not be duplicated.

All of February 24th was spent adjusting the NRC guns/atomizers and burner registers to obtain the optimum flames that could be obtained with the new CWF. Once this level of performance had been reached arrangements were made to have NB Power's boiler efficiency team return to the Chatham Plant to conduct the required boiler tests. They had been on-site the week of Feb. 17 to 21, 1986 but could not undertake any testing because of the vacuum problems.

On February 25th, the CWF had further deteriorated and only the following three tests could be conducted:

Test No. 1	Maximum obtainable load, with two large NRC gun/atomizers in-service, using air atomization, and no support from either light oil ignitions or heavy fuel oil gun.
Test No. 2	The same as test No. 1 but with steam atomization. Due to an unstable fire in the No. 4 burner, a light oil ignition had to be put in-service in this burner.
Test No. 3	Again, maximum obtainable load using the two large NRC gun/atomizers burning heavy fuel oil with steam atomization.

Test No.1 and No.3 were completed successfully but Test No. 2 had to be cut short because of the unstable fire in burner No. 4. The results of these tests are detailed in section 12 of this report.

11.10 March 5 to 7, 1986

The second shipment of new CWF had been received, and this fuel was to be used to obtain the maximum number of operating hours on the baghouse burning under the following conditions:

- 100% CWF firing
- 100% oil firing
- combination of both
- switching between various modes of operation

The No. 1 burner, with the modified burner throats and the large NRC gun/atomizer was quickly brought into service. This gun was in continuous service for 26 hours, with no light oil ignitors. For the first 8 hours of operation air atomization was used, and steam atomization for the remaining 18 hours. This was by far the longest continuous period of time any CWF gun/atomizer had been in service, with steam atomization, during all of the CWF demonstrations conducted at the Chatham Plant over the previous three years.

The No. 4 burner was in service for a number of hours with the original burner register and the new swirler, but a fire as stable as in No. 1 could not be obtained.

The No. 1 burner stayed in service until all the fuel in the storage bunker had been consumed but the No. 4 burner had to be removed from service before this point was reached. This was because the fuel at the bottom of the bunker was changing consistancy, and the No. 4 burner could not handle these changes, whereas the No. 1 burner could.

No more testing could be undertaken because a commitment had been made to take the Unit No. 1 Boiler out of service after this date.

12.0 Results of Test Programs

As on the earlier coal-water fuel and burner demonstrations, the nature of the program changed from that of a demonstration to more of a development program.

Again it is felt that significant advances were made during this demonstration in the following areas:

12.1 Burner register design

NRC showed that recirculation within the original burner flame could be improved by changing the primary combustion air swirler. This was covered in detail in section 8.4 of this report.

12.2 Burner throat design

EMR CANMET did extensive work on reshaping both the primary combustion air throat, and secondary combustion air throat. This produced a much improved flame with good stability with either steam or air atomization, and good recirculation within the flame, which improved the burnout of the fuel. The reshaped burner throats produced a short bushy flame, as would be required for boilers that had originally been designed to burn only fuel oils. This is because such boilers have a smaller furnace area than boilers designed to burn coal. These changes are covered in detail in sections 8.2 and 8.3 of this report.

12.3 Gun and atomizer design

NRC first became involved in the development of atomizers during the original CWF burner demonstrations, when they were asked by one the suppliers to manufacture ceramic inserts for the burner atomizers. From this involvement, they developed their own CWF gun and atomizer.

Their gun and atomizer had two main advantages over the original ones:

- The width of the path for the fuel and atomizing medium between the atomizer tip and orifice ring could be varied while the gun was in service. This allowed adjustments to be made to compensate for changes in the consistency of the fuel.

- The flow paths through both the gun and atomizer were improved over the original CWF guns, which reduced the pressure loss and further improved atomization.

During this demonstration, NRC worked with three sizes of guns they had designed and manufactured. This gave them very valuable experience in scaling up the size of both their gun and atomizer.

Due to the versatility of the NRC gun and atomizer, it was demonstrated that it could burn CWF with either air or steam atomization, and could readily be switched to heavy fuel oil firing by changing the fuel supply. The Unit No. 1 burner front at the Chatham Plant had been designed so that this could be accomplished by closing the CWF supply valve and opening the heavy fuel oil supply valve. The switch could also be made from heavy fuel oil to CWF.

12.4 Boiler efficiency test results

As has already been covered in section 11.9, the boiler efficiency tests were conducted in less than ideal conditions, on Feb. 25/86. The tests were undertaken even though the fuel was in very poor condition, because it was not known if there would be a second opportunity to conduct the efficiency test. As it turned out, the following week when good firing was experienced, with new CWF, there was a major snowstorm preventing personnel from travelling to the Chatham Plant on short notice. The test could not be delayed until the following week because, based upon the experience of Feb. 25, 1986, it was not known if the fuel would remain stable until that time, and a commitment had been made to complete all the work on the Unit No. 1 Boiler by March 7, 1986.

The results of the test from Feb. 25, 1986 are given in table 12.1, and the full efficiency report is included in section 16.9 of the appendix to this report.

In table 12.2, the results are given of earlier efficiency test programs.

It will be seen from these tables that the results of the February 25, 1986 tests are generally lower than the earlier tests. This can be explained by the following reasons:

- Poor CWF with a very low viscosity.
- Low load on the unit, as there were only the two large NRC guns available.
  The medium size NRC guns had not been returned to the Chatham Plant.
- The operators had not had very much experience with either firing heavy fuel oil in the large NRC guns, or with CWF and steam atomization.
- It has always been noted when firing CWF that the better fires were obtained when the boiler was at, or close to full load, with a large amount of heat in the furnace area of the boiler.

12.5 Output of boiler on March 6 to 7, 1986

The large NRC gun was run continuously in the No. 1 burner from 11:30 a.m. on March 6th until 1:00 p.m. on March 7th, 1986. Air atomization was used for the first 8 hours, then the gun was switched to steam atomization and run in this mode of operation for 18 hours until all the CWF on site had been consumed.

TABLE 12.1

SUMMARY OF TEST RESULTS

CHATHAM UNIT NO. 1 BOILER EFFICIENCY TEST

WITH COAL-WATER FUEL (CWF) AND NO. 6 fuel OIL

				PERCENT LOSSES						
Test No.	Firing Mode	Test Date	Unit Load MWe	Dry Gas	Moisture in Fuel*	Unburnt Comb.	Moisture in Air	Radiation	Unmeas.	Total Boiler Efficiency %
1 **	Carbogel with Air Atomization	Feb. 25/86	3.7	8.548	7.237	5.835	0.110	1.000	1.500	75.770
2 ***	Carbogel with Steam Atomization	Feb. 25/86	2.6	10.503	7.328	11.277	0.146	1.000	1.500	68.247
3	No. 6 Oil with Steam Atomization	Feb. 25/86	2.6	12.862	6.151	0.160	0.168	1.000	1.500	78.159

NOTES:

- Only burners No. 1 and No. 4 were used because there were only two large NRC guns.

* - Total loss from moisture in fuel plus H_2O from combustion of H_2.

** - A light oil ignitor had to be kept in Burner No. 4.

*** - Burner No. 4 had to be switched to air atomization with a light oil ignitor in service.

TABLE 12.2

SUMMARY/COMPARAISON

CHATHAM NO. 1 BOILER EFFECIENCY

OIL AND CARBOGEL FIRING

(NB POWER DATA)

			PERCENT LOSSES						
Firing Mode	Test Date	Unit MW Load	Dry Gas	Moisture* In Fuel	Unburnt Comb.	Moisture In Air	Radiation	Unmeas.	Total Blr. Efficiency
No. 6 Oil	83.07.19	9.8	7.94	6.15	0.36	0.26	0.50	1.00	83.80
	83.07.19	7.4	8.70	6.15	0.36	0.20	0.65	1.00	82.94
	83.07.18	5.0	6.07	6.02	0.36	0.20	0.85	1.00	85.51
Carbogel	84.01.19	9.8	7.75	6.95	4.10	0.19	0.55	1.50	78.97
	84.07.16	9.7	6.68	8.00	2.11	0.20	0.50	1.50	81.00
	84.01.19	7.7	9.00	7.23	2.81	0.23	0.60	1.50	78.64
	84.06.27	7.5	6.93	7.34	10.87	0.21	0.55	1.50	72.60
	84.01.20	5.4	8.81	6.81	3.78	0.21	0.75	1.50	78.14
	84.06.27	5.2	8.52	7.37	14.68	0.19	0.80	1.50	66.94
	84.07.17	5.4	10.55	7.51	3.91	0.26	0.70	1.50	75.56

REMARKS: *Total loss from moisture in fuel plus H_2O from combustion of H_2.

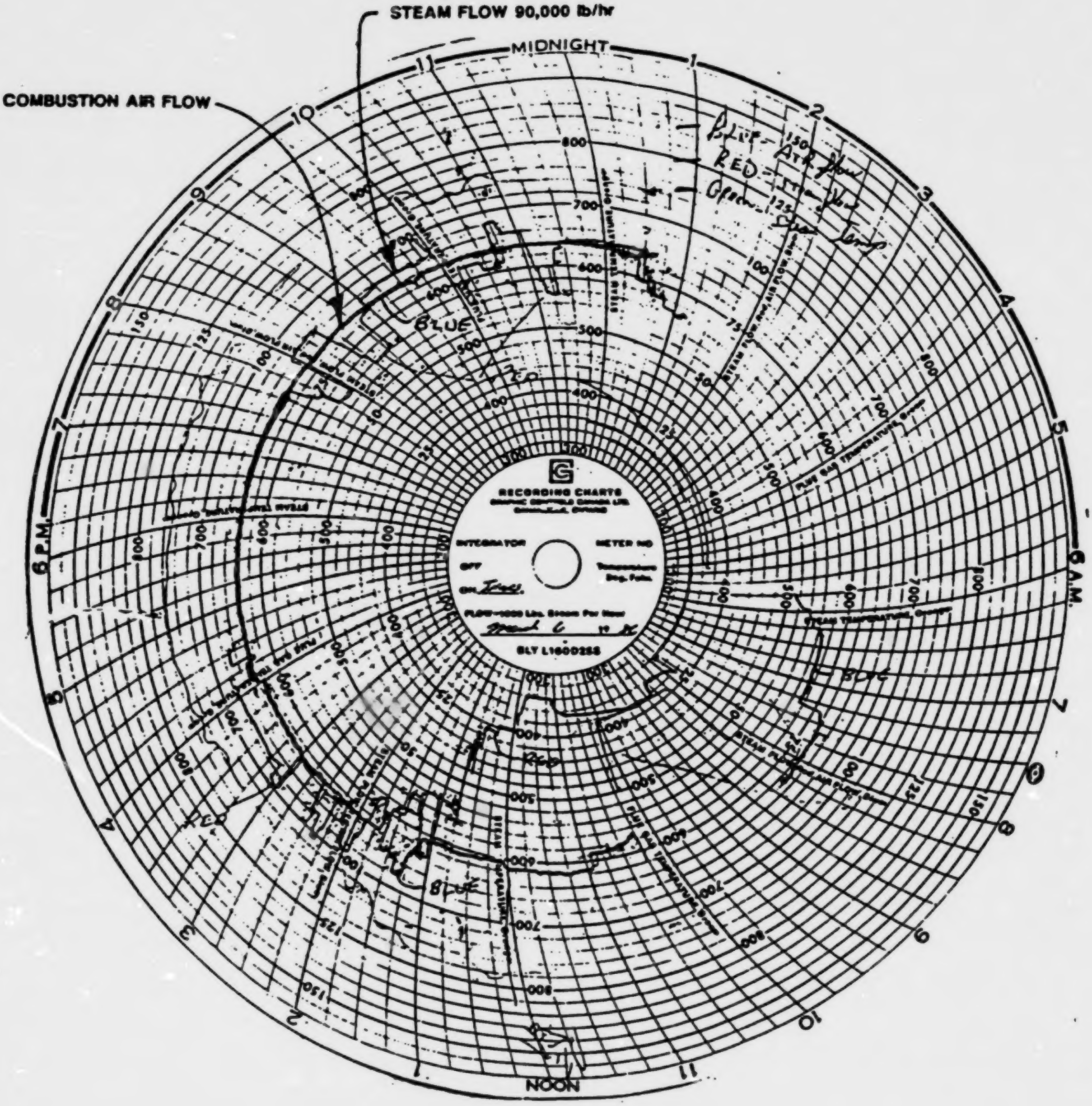
From start up until late in the evening, the No. 4 burner, with the second large NRC burner, was in and out of service while the operators tried to improve the stability of the flame with either air or steam atomization. Overnight, the No. 1 burner, with the large NRC gun firing CWF, was held steadily at full load with the required extra heat in the boiler being supplied by two heavy fuel oil guns, both at ½ load. From the steam flow charts, figures 12.1 and 12.2, it can be seen the output of the boiler during this time was constantly 75.000 lb/hr, which is equal to 62.5% of full load.

- full load = 120,000 lb/hr.
- actual load = 75,000 lb/hr.
- load in the unit is 62.5% of full load.
- full load heat input is supplied by 4 guns rated at 40×10^6 BTU/hr each for a total of 160×10^6 BTU/hr.
- Therefore, the required heat input for a 62.5% load is 100×10^6 BTU/hr.
- Two oil guns at half load would have a heat output in the range of 40 to 45×10^6 BTU/hr.
- Therefore, the large NRC, CWF gun, with steam atomization, was supplying the remainder of the required heat input to carry this load which is equal to:
  $100 \times 10^6 - 45 \times 10^6 = 55 \times 10^6$ BTU/hr.

This is the output the large NRC gun/atomizer was designed to give, and well above the capacity of the burner No. 1 register.

This clearly shows that the new and large NRC gun/atomizers, operating in the burner with the EMR modified burner throats, were more than capable of reaching their designed load, when supplied with Carbogel CWF that met the fuel specification.

The large bushy CWF flame produced by the NRC gun/atomizer in burner No. 4 can clearly be seen in figures 12.3 a view of the flame from the access port in the back-wall of the boiler, and figure 12.4 a view of burner Nos. 1 and 4 view from the access door in the ash pit of the boiler. The good burnout of the CWF during the March 6 to 7, 1986 run can be seen from figure 12.5 which is a view of the boiler floor after the unit had been in service for 26 hours burning Carbogel CWF.

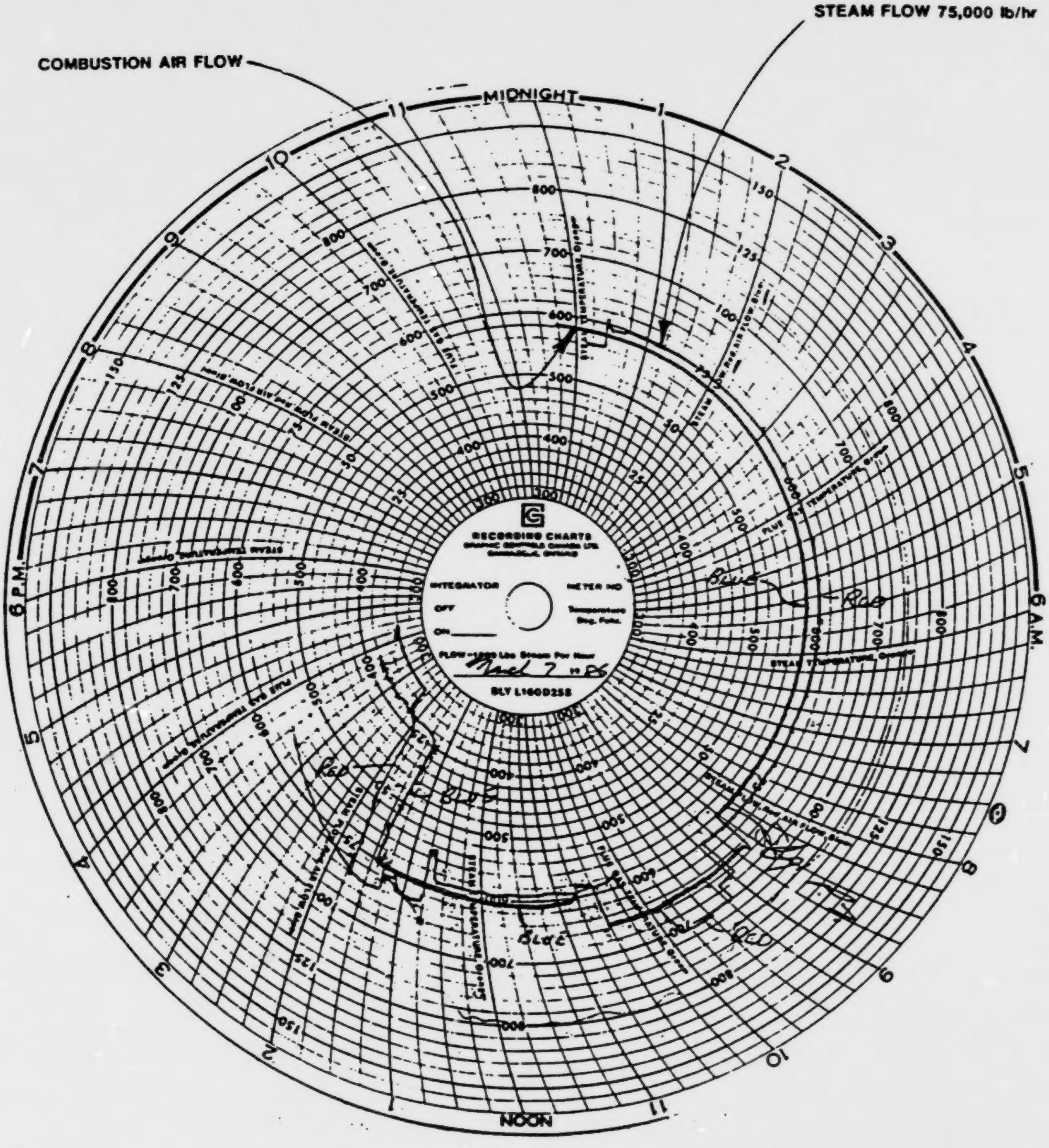


STEAM FLOW 90,000 lb/hr

COMBUSTION AIR FLOW

CHATHAM UNIT No.1 BOILER,STEAM FLOW CHART SHOWING
THE ACTUAL LOAD ON THE BOILER FOR MARCH 6/86

FIG. No.12.1



CHATHAM UNIT No.1 BOILER,STEAM FLOW CHART SHOWING THE ACTUAL LOAD ON THE BOILER FOR MARCH 7/86

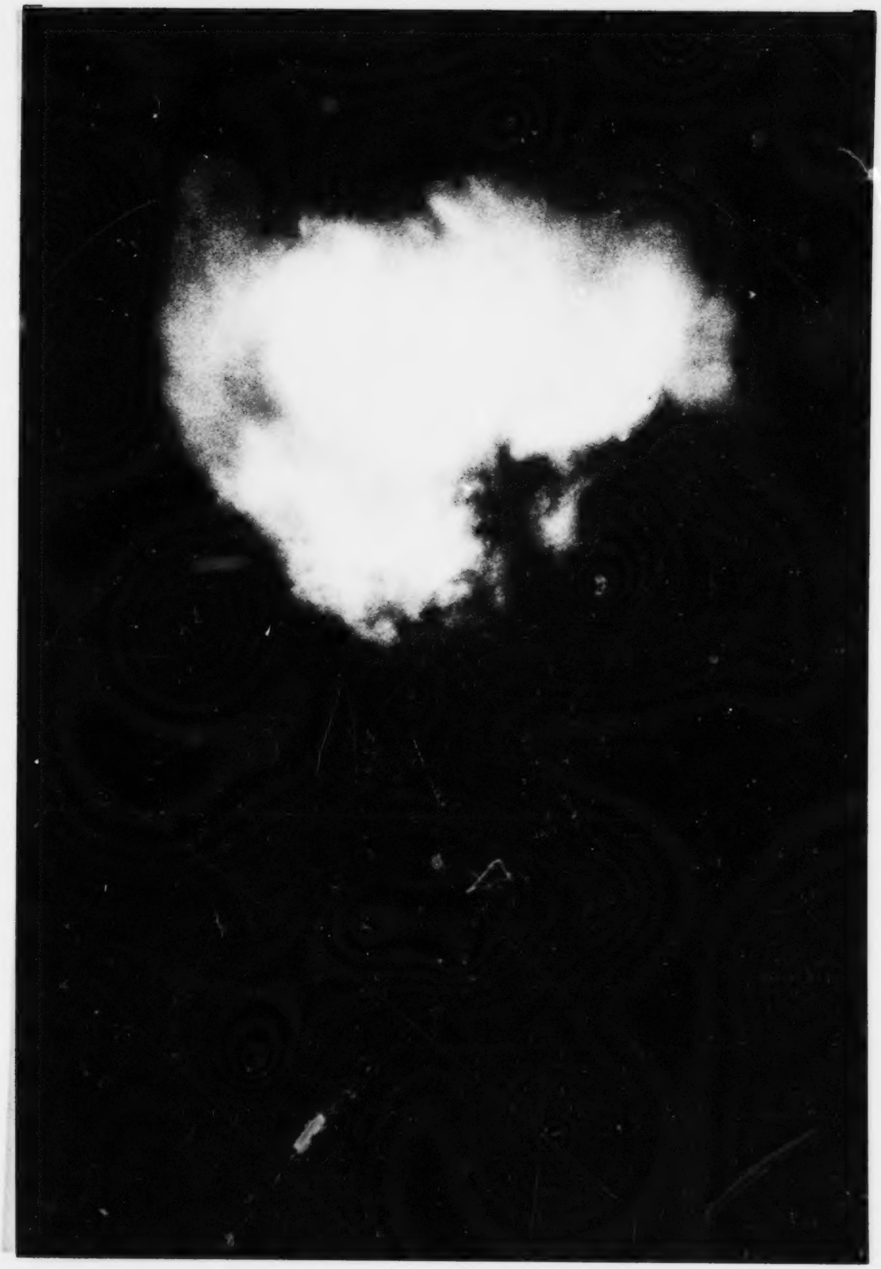
FIG. No.12.2

CHATHAM UNIT No.1 BOILER

COAL-WATER FUEL FLAME VIEWED FROM THE

BACK OF THE BOILER

FIG. No.12.3



CHATHAM UNIT No.1 BOILER

COAL-WATER FUEL FLAME VIEWED

FROM THE ASH PIT

FIG. No.12.4

CHATHAM UNIT No.1 BOILER

FLOOR OF BOILER AFTER THE UNIT HAD BEEN IN-SERVICE,BURNING C.W.F. FOR 25 HOURS

FIG. No.12.5

13.0 Coal-Water Fuel Problems

The initial allocation of 'Carbogel' coal-water fuel from C.B.D.C. for this demonstration was 400 tonnes. This was delivered in two shipments of 3 rail tank cars each.

The first shipment of 3 rail tank cars of CWF was delivered to the Chatham Plant in late April 1985, and was unloaded into the in-plant storage bunker.

The second shipment was received in early July 1985 and had to be left in the 3 rail cars because the in-plant storage bunker was not available.

The first shipment of Carbogel fuel started to settle after it had been in the storage bunker for six weeks, and by mid-July 1985, recirculation would not keep the coal in the CWF in suspension.

It was felt the bacteria in both the coal and air had attacked the additives in the fuel. This caused the fuel to become so unstable it had to be rehabilitated before it could be used. This was done by first sterilizing the fuel in the bunker by the addition of FORMALIN. After this pre-treatment, new stabilizer was added to the bunker and mixed with the CWF by recirculating both the stabilizer and CWF through the in-plant fuel system.

All of this reworked fuel was consumed by mid-August 1985, while conducting burn tests in both the unit No. 1 boiler, and the unit No. 2 boiler.

The second shipment of Carbogel was kept in the three rail tank cars without any problem from its arrival at the Chatham Plant on July 5th until September 25, 1985. Nothing was done to the fuel, apart from a weekly check, to test if there had been a change in the viscosity and to see if either water was forming on top of the fuel, or a sludge building up in the bottom of the tank car.

A week later on October 1, 1985 it was noted the CWF in all three rail cars was starting to settle. At that time, about five tonnes of fuel were unloaded from one rail tank car after remixing the CWF in the car with air lances. This allowed a short test to be conducted with the new and larger NRC gun.

Five weeks later, when all parties were available to continue the NRC burner demonstration, the fuel had degenerated to such an extent that it all had to be rehabilitated before it could be used for more testing of the new and large NRC gun/atomizer.

There were a number of problems encountered while rehabilitating this fuel, some of which were:

- the CWF had settled to such an extent, great difficulty was experienced in pushing an air lance down through it. The compressed air from the air lance was used to re-mix the settled CWF.

- determining how much of the fuel additives should be added, because if some of the original additives were still in the fuel, and a full dose of additives were added, the fuel would become so stable it would not atomize.

- if all the settled coal was not brought back into suspension, the moisture content of the CWF would be too high, which would result in poor fires.

- combining the remixed fuel from the rail cars and the new additives was a problem because the Chatham Plant had not been equiped with fuel mixing facilities. The only method of mixing fuel and additives once they were in the storage bunker was to recirculate then through the in-plant fuel piping system.

One of the main problems during this time was the lack of effective co-operation from either A. B. CARBOGEL in Sweden, who had developed the method of coal-water fuel preparation used for this demonstration, and C.B.D.C. (The Cape Breton Development Corporation) who had prepared the CWF, shipped to the Chatham Plant.

C.B.D.C. discontinued their practice of supplying the Chatham Plant with the three fuel additives:

- Sterilizer (FORMALIN)
- Stabilizer
- Dispersant

until N.B. Power agreed to employ C.B.D.C's personnel to rehabilitate the fuel, because they claimed their personnel were the experts in doing this work.

The problem with C.B.D.C.'s insistences on being employed to do this work was in the past when NB Power's Chatham personnel had been reworking fuel, no one from either A. B. Carbogel or C.B.D.C. had come the the Chatham Plant to become involved with the retreatment of problem fuels. Therefore, they had not developed any field experience in this type of site work.

A detailed report covering the rehabilitation of these three rail cars of settled fuel is included in the appendix to this report.

When the demonstration program was resumed in February 1986, the first shipment of 100 tonnes of CWF received at the Chatham Plant became unstable within two weeks. It was felt by C.B.D.C. this had resulted from the CWF system being less than half full of fuel, therefore, the CWF was being subjected to more recirculation than normally. The Chatham Plant operators did not agree with this, because when the boiler was out of service the CWF was only recirculate for one hour a day to prevent it from settling and plugging the pipelines.

The second shipment of 100 tonnes was used as quickly as possible, and no fuel related problems were encountered.

The following things have been learnt during this demonstration:

- Carbogel, coal-water fuel, can be stored in tanks (over 60 tonnes capacity) for up to 3 months without any agitation. If the tank is in an outside location, some exterior heating would be required in the cold weather months. The test conducted during this demonstration program was in an insulated but unheated, rail tank car from early July to late September.
- Once Carbogel, CWF, is put in a fuel supply system where it is subjected to flow through pumps, control valves, small bore pipes, and partly full storage tanks, it can become unstable in as short a time as two weeks.
- The coal-water fuel can be rehabilitated under site conditions, but some in-line additive injections and in-line mixing equipment should be installed in the user's plant for doing this type of work.

14.0 Environmental

As in the earlier CWF demonstrations program, meeting the required environmental standards continued to be a problem in the early part of this demonstration.

Even when an optimum level of CWF firing had been achieved, the opacity readings were close to, or above the maximum level that is required for the Chatham Plant.

This was in part overcome by running the combustion air fans in the adjacent boiler. This could be done because both the boilers in the Chatham Plant use a common boilerhouse stack. Therefore, the volume of gas flow up the stack could be increased by running the combustion air fans for the boiler not in service. This diluted the flue gas of the boiler in operation, and resulted in a reduction of the opacity of the flue gas.

Such a method of operation can only be used for a short test program but is by no means an acceptable solution for continuous operation.

As it had been shown in this and the earlier CWF demonstration burns, high opacity will be a chronic problem when firing coal-water fuel because a coal based fuel is being burnt. For this reason, the Project Steering Committee added a flyash collection test to this demonstration.

In the preparation of the coal-water fuel used for the demonstrations at the Chatham Plant, the ash content of the fuel is reduced by precleaning of the coal. This results in a CWF with a very low ash content, which in turn produces a flyash which is relatively high in carbon (unburnt fuel). As flyash which is high in carbon and low in ash does not work well in electric precipitators, it was decided by the Project Steering Committee that a baghouse would be used for the flyash collection test.

The flyash collection can be further complicated because light-fuel oil ignitors are used on start-up, and at times heavy fuel oil guns are in service in conjunction with the CWF guns. This can cause the fabric bags to become "blinded" with the sticky ash from the fuel oils.

When the baghouse was tested in February - March 1986 it resulted in a reduction of the opacity from the boiler house stack, and the collection of a large amount of flyash.

During the baghouse test program, three types of bag fabrics were tested to determine which fabric would be the most suitable for collecting the flyash when firing CWF and/or fuel oil.

A procedure had to be developed for operating under the following conditions:

- light-fuel oil ignitors on start-up
- 100% heavy fuel oil firing
- 100% CWF firing
- a combination of H.O. and C.W.F. firing
- switching from one mode of operation to the other

A number of other methods were investigated for reducing the opacity, which included:

- adding a nozzle at the discharge of boiler house stack to increase the exit velocity of the flue gas. This would have improved plume rise from the stack, which would cause the particulate to be carried further from the plant. Also, if the column of flue gas rising from the stack had a smaller diameter, its opacity would be less.

- heaters in the beeching, or stack, to raise the temperature of the flue gas to improve the plume rise from the stack.

- dilution of the flue gas by the addition of extra air to the flue gas in the stack.

All of these methods were rejected because although they would have reduced the opacity of the flue gas leaving the stack, and also reduce the particulate deposited in the area of the plant, none of them would actually reduce the total amount of particulate within the flue gas. For these reasons, the program was set up to test a baghouse that would remove some or all of the particulate when firing CWF and/or fuel oil.

The results of the baghouse test program and the operating procedure are detailed in a separate project report.

Flyash collection problems are common to both CWF and coal firing but coal-water fuels solve a number of other problems which are experienced when handling and firing untreated coal.

- CWF being a slurry is easy to pump.
- It can be ready loaded into a truck, rail car tank, or ship for transportation, and as easily off-loaded.
- There are no dust problems.
- Within a plant, it can be pumped through relatively small diameter pipe lines, whereas pulverized coal requires large diameter pipe lines to be blown through.
- Dry pluverized coal is a hazardous material to handle, whereas when mixed with water, as a slurry, it is quite safe.
- Both the ash and sulphur content were reduced in the preparation of the CWF used for this demonstration.
- The CWF can be stored in closed tanks.
- No on-site treatment is normally required, whereas coal requires packing on the coal pile, reclaiming, crushing and pulverizing.

15.0 Conclusions

The original objectives of this demonstration were to test the NRC ceramic, coal-water fuel atomizers at 40 x 10^6 BTU/hr (40 GJ/h) and conduct a boiler efficiency test of the Chatham unit No. 1 with the NRC atomizers in service.

These objectives were met, plus the following additional ones:

- it was demonstrated the NRC gun/atomizer can be run continuously, with either steam or air atomization, without any support ignition.
- NRC have built CWF gun/atomizers in three sizes:
  - 10 x 10^6 BTU/hr (10 GJ/h)
  - 25 x 10^6 BTU/hr (25 GJ/h)
  - 55 x 10^6 BTU/hr (55 GJ/h).
- From building these gun/atomizers, NRC have developed the experience to scale up their guns and atomizers and predict what their capacity will be.
- The NRC gun/atomizers will burn either CWF or heavy fuel without changing the atomizer tips.
- EMR-CANMET, have developed a burner register design which is compatible with the NRC gun/atomizers.
- When the NRC gun/atomizer was installed in the EMR modified burner, it operated with steam atomization, without any plugging, for a longer period of time than any other gun/atomizer tested at the Chatham Plant during all the CWF demonstrations between 1983 and 1986.
- The efficiency test showed the NRC gun/atomizer operating in the EMR modified burner had a good carbon conversion. This was also shown by the low opacity and very small amount of bottom ash on the furnace floor.
- NRC developed and improved the primary combustion air swirlers for the original burners.
- NB Power's operating personnel gained a great deal more experience in handling and firing coal-water fuels.
- A large amount of experience was gained by NB Power's Chatham personnel in rehabilitating coal-water fuel that had settled, or in which the fuel additives had decayed.

- A better appreciation was gained on just how sensitive the Carbogel CWF is to handling and how quickly it can degenerate.
- A long-term static storage test was conducted on three 70 tonne tanks of Carbogel CWF.
- A separate program was developed to test flyash collection when burning CWF and/or fuel oils. (A separate report has been prepared covering this demonstration.)

From the promising results of this demonstration it is felt the N.R.C. gun/atomizers are now ready to be installed in a larger boiler as part of the continuing coal-water fuel and CWF burner development.

N.R.C. BURNER DEMONSTRATION
AT
NB POWER'S CHATHAM T.G. STATION

SECTION 16 - APPENDIX

SECTION	TITLE	PAGE
16.1	Agreement	
16.2	Project Schedule and List of Events	
16.3	Cost Summaries	
16.4	Major Purchase Orders	
16.5	Project Reports	
16.6	Report covering: The problems when rehabilitating the settled CWF in November 1985	
16.7	Site Fuel Reports	
16.8	Unit No. 1 Boiler Efficiency Test Data Sheets	
16.9	Report on the Unit No. 1 Boiler Efficiency Test conducted on Feb 25th, 1986.	

N.R.C. BURNER DEMONSTRATION

AT

NB POWER'S CHATHAM T.G. STATION

SECTION 16.1

AGREEMENT COVERING THIS DEMONSTRATION

WITH

DSS CANADA

Supply and Services Canada　Approvisionnements et Services Canada

11 LAURIER ST., HULL, QUEBEC K1A 0S5
11, RUE LAURIER, HULL (QUÉBEC) K1A 0S5

CONTRACT AMENDMENT
MODIFICATION DE CONTRAT

The New Brunswick Electric Power Commission
515 King Street
Fredericton, New Brunswick
E3B 4X1

83N73

P.I. - I.P.	PAGE 1 OF DE 1
DSS FILE NO. - Nº DU DOSSIER MAS 06SQ.23440-4-9323	
ADDRESS ENQUIRIES TO: ADRESSER LES DEMANDES DE RENSEIGNEMENTS À Dr. R.G. Agarwal (06SQ) TEL. TÉL. (819/613) 997-7420	

THE REFERENCED CONTRACT IS HEREBY AMENDED AS FOLLOWS - CE CONTRAT EST PAR LES PRÉSENTES MODIFIÉ COMME SUIT

MENDMENT NO. - DE LA MODIFICATION	DATE	TYPE OF AMENDMENT - GENRE DE MODIFICATION	AMENDMENT VALUE VALEUR DE LA MODIFICATION	REVISED TOTAL EXPENDITURE MONTANT GLOBAL REVISÉ
1	JAN 31 1986	☒ INCREASE AUGMENTATION ☐ DECREASE DIMINUTION ☐ NO CHANGE AUCUN CHANGEMENT	$243,700.00	$495,700.00

TITLE:　COMBUSTION TESTING OF CERAMIC COAL-WATER FUEL (CWF) ATOMIZERS IN UNIT NO.1, CHATHAM, NEW BRUNSWICK, GENERATING STATION (no change)

At STATEMENT OF WORK, APPENDIX "A"

ADD:　APPENDIX "A - 1" attached

On page 1, at DELIVERY block

INSERT: June 30, 1986

On page 4, BASIS OF PAYMENT

DELETE: in its entirety
INSERT: APPENDIX "E"

EXPENDITURE INCREASE AUTHORIZATION

Her Majesty's liability to you under this contract from $252,000.00 by $243,700.00 to $495,700.00 is hereby authorized, subject, however to all the terms and conditions of this contract.

ALL OTHER TERMS AND CONDITIONS OF THE CONTRACT REMAIN UNCHANGED
TOUTES LES AUTRES MODALITÉS ET CONDITIONS DU CONTRAT DEMEURENT INCHANGÉES

REQUISITIONING DEPT. - MINISTÈRE DEMANDEUR	INSPECTION	C. OF PC - C. DE T.é.é.	VALUE OF PC VALEUR DE T.é.é.
Energy, Mines & Resources 23	☒ CONSIGNEE CONSIGNATAIRE ☐ DSS PQD MAS DBP ☐ DND QAD MDN DAQ	CDN	----

All invoices, shipping bills and packing slips must show the following numbers Les factures, connaissements et fiches d'emballages doivent porter les numéros suivants	REQUISITION NO. AND FINANCIAL CODES - Nº DE LA DEMANDE ET CODES FINANCIERS RN: 23440-4-9323 FC: 234-131-000000-506802-0415	CONTRACT SERIAL NUMBER NUMÉRO DE SÉRIE DU CONTRAT 0SQ84-00423

SM/PM - MS/MEP	VSP - LAP	GSIN - NIBS	CONTRACT DATE - DATE DU CONTRAT	APPROVAL AUTHORITY FONDÉ DE POUVOIR D'APPROBATION
07/05 +$ 68,850.00 07/08 +$174,850.00	E3B	Z-0001-N-I-D	MAR 13 1985	Director General

DSS-MAS 1090B (3/83)

FOR THE DEPARTMENT
POUR LE MINISTÈRE　E.K.
SIGNATURE

Canada

APPENDIX "A - 1"

STATEMENT OF WORK

TITLE: COMBUSTION TESTING OF CERAMIC COAL-WATER FUEL (CWF) ATOMIZERS IN UNIT NO. 1, CHATHAM, NEW BRUNSWICK, GENERATING STATION

Task 1 and 2 are completed

Task 3 Incineration of CWF

You will dispose of by incineration CWF which was purchased for tasks 1 and 2 but which had deteriorated as a result of an unanticipated prolonged storage period. You will also undertake such measures that may aid in restabilizing the CWF in consultation with the scientific authority.

Task 4 Acquisition of CWF

You will undertake to obtain 200 tonnes of CWF which meet the specifications designated for the Charlottetown CWF utility boiler demonstration and which will be used for tasks 5 and 6.

Task 5 Boiler Performance Testing

You will undertake to prepare and operate unit number 1 boiler at Chatham for a four week period of testing. The atomizers used will be those developed by the NRC during tasks 1 and 2. Boiler performance will be measured at boiler loads commensurate with the environmental limitations applicable in New Brunswick. Comparative performance will also be obtained for heavy fuel oil using the same atomizers. The test program will be developed in consultation with the Scientific Authority.

Task 6 Fabric Filter Evaluation

During Task 5 you will evaluate a fabric filter for its effectiveness in collecting the flyash from CWF combustion and heavy fuel oil and combinations thereof. Various filter materials will be evaluated. The test program will be developed in consultation with the Scientific Authority.

Task 7 Reporting

Within 2 months of completing tasks 5 and 6 you will provide the scientific authority with a draft report containing all relevant burner and boiler operating parameters from tasks 4, 5 and 6 and the assessment of baghouse performance and materials.

After review by the scientific authority, five copies of the final report will be issued to the scientific authority.

NOTES:

1) The CWF transportation and cost is included in this contract. Some of this fuel may contain sulphur-oxide sorbents if this proves possible.
2) The CWF atomizers are the resonsibility of the Chemical Engineering Section, Chemistry Division, NRC.
3) The baghouse installation and materials costs are not part of this contract.

APPENDIX "E"

BASIS OF PAYMENT

You shall be paid in accordance with the following, subject to a limitation of expenditure of $495,700.00

1. **Labour** - at hourly rates, inclusive of overhead, exclusive of profit or fee, calculated in accordance with the following formula	Est. $202,850.00
Hourly Rate for Engineering: actual annual salary multiplied by the firm multiplier of 0.0007161	
Hourly Rate for Plant and Trade: actual annual salary multiplied by the firm multiplier of 0.0006490	
2. **Equipment** - at laid down cost without mark-up: Opacity Meter	Est. $ 30,000.00
3. **Consumable Materials from Stores** - at cost plus 15% mark-up	Est. $ 37,000.00
i.e. lubricating oil, gaskets, replacement of parts consumed during the operation	
4. **Travel and Living** - at actual cost plus 15% mark-up, but not to exceed Treasury Board Travel Directive Guidelines current when incurred	Est. $ 26,600.00
5. **Direct Charges** - at laid down cost without mark-up	Est. $231,250.00
Rental of air compressors Bunker oil to support combustion Light oil (No.2) for light-off and running the air compressors Delivery of fuel, FOB Chatham plant from CBDC, Sydney, N.S.(no charge)	
6. **Credit for Energy** - the net energy produced from the project will be credited to the Crown at the New Brunswick Power incremental rates during the actual period of the test.	Est.($ 32,000.00)
TOTAL ESTIMATED COST TO A LIMITATION OF EXPENDITURE:	$495,700.00

NRC

Supply and Services Canada   Approvisionnements et Services Canada

11 LAURIER ST., HULL, QUEBEC K1A 0S5
11, RUE LAURIER, HULL (QUÉBEC) K1A 0S5

4:4

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DSS FILE NUMBER – NUMÉRO DU DOSSIER MAS
06SO.23440-4-9323

ADDRESS ENQUIRIES TO
ADRESSER LES DEMANDES DE RENSEIGNEMENTS À
Dr. R.G. Agarwal
TEL.: (819/613) 997-7420

The New Brunswick Electric Power Commission
515 King Street
Fredericton, N.B.
E3B 4X1

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CONTRACT - CONTRAT

YOU ARE REQUESTED to sell and/or supply to Her Majesty the Queen in right of Canada upon the terms and conditions set out herein and on the reverse side hereof, the supplies and/or services listed below and any attached sheets at the price(s) set out therefor.

NOUS VOUS DEMANDONS de vendre et(ou) de fournir à Sa Majesté la Reine du chef du Canada, aux conditions énoncées au recto et au verso de la présente et au(x) prix indiqué(s) les articles et(ou) les services énumérés ci-dessous et sur toute feuille ci-annexée.

. POINT / POINT DE f. à. b.: Ottawa, Ontario

CONSIGNEE / CONSIGNATAIRE:
Department of Energy, Mines & Resources
CANMET, Energy Research Laboratories
555 Booth Street, Ottawa, Ontario, K1A 0G1
ATTEN: Dr. H. Whaley

CODE 23440

INSPECTION: ☐ CONSIGNEE / CONSIGNATAIRE ☐ DSS / MAS ☐ DND / DAD / MDN / DAD

REQUISITIONING DEPARTMENT – MINISTÈRE DEMANDEUR: Energy, Mines & Resources 23

ITEM NO. / Nº DE L'ARTICLE	GSIN (NOT A PART NO.) / NIBS (DIFF. DU Nº DE PIÈCE)	DESCRIPTION	U OF I / U DE D	QUANTITY / QUANTITÉ	UNIT PRICE / PRIX UNITAIRE
	Z-0001-N-I-D				

TITLE: COMBUSTION TESTING OF CERAMIC COAL-WATER FUEL (CWF) ATOMIZERS IN UNIT NO.1, CHATHAM, NEW BRUNSWICK, GENERATING STATION

STATEMENT OF WORK

You shall undertake the work as specified in Appendix "A" attached hereto and forming part of this contract. The general approach will be in accordance with your technical proposal, file Chatham - CWF No.4, dated February 6, 1985.

PRECEDENCE OF DOCUMENTS

In the event of conflict, the precedence of documents shall be as follows:
a) the contract;
b) your technical proposal dated February 6 1985.

CONSIGNEE / CONSIGNATAIRE	VALUE – VALEUR	CONSIGNEE / CONSIGNATAIRE	VALUE – VALEUR	COUNTRY OF F.C. / ORIGINE F.C.É. CDN	VALUE OF FOREIGN CONTENT / VALEUR ÉLÉMENTS ÉTRANGERS
CONSIGNEE / CONSIGNATAIRE	VALUE – VALEUR	CONSIGNEE / CONSIGNATAIRE	VALUE – VALEUR	REVENUE SHARING – PARTAGE DES RECETTES	

DELIVERY / LIVRAISON: July 15, 1985
FROM DATE OF AWARD OF CONTRACT / À PARTIR DE LA DATE D'ADJUDICATION DU CONTRAT

TELEPHONE:
DATE:

FEDERAL SALES TAX / TAXE DE VENTE FÉDÉRALE: Included where Applicable

We hereby AGREE to sell and/or supply to Her Majesty the Queen in right of Canada, upon the terms and conditions set out herein and on the reverse side hereof, the supplies and/or services listed above and on any attached sheets at the price(s) set out therefor.

Nous CONSENTONS de vendre et(ou) de fournir à Sa Majesté la Reine du chef du Canada, aux conditions énoncées au recto et au verso de la présente et au(x) prix indiqué(s) les articles et(ou) les services énumérés ci-dessus et sur toute feuille ci-annexée.

PRINT NAME – NOM EN MAJUSCULES:

SIGNATURE:

DISCOUNT TERMS / MODALITÉS D'ESCOMPTE: N/A

INVOICES ARE TO BE MADE OUT TO – ÉTABLIR LES FACTURES AU NOM DE

Send the ORIGINAL and / Envoyer l'ORIGINAL et [3] copies to / exemplaires au ▶ Senior Science Procurement Officer

☒ Send one copy to DSS / Envoyer un exemplaire au MAS ▶ ~~Scientific Authority~~

All invoices, shipping bills and packing slips must show the following numbers
Les factures, connaissements et inventaire du contenu doivent porter les numéros suivants

REQUISITION NO. AND FINANCIAL CODES – Nº DE LA DEMANDE ET CODES FINANCIERS:
RN: 23440-4-9323
FC: 214-131-000000-434251-0415

CONTRACT SERIAL NUMBER / NUMÉRO DE SÉRIE DU CONTRAT: 0SQ84-00423

F.PM. - PAC/MEP	EST. EXPENDITURE – MONTANT EST.	DATE	FOR THE DEPARTMENT – POUR LE MINISTÈRE
/05 ($134,000.) 8 ($118,000.)	$252,000.00	MAR 13 1985 VSP – LAF: E3B	P J Somson SIGNATURE

5 1100E (10 83)

TERMS AND CONDITIONS

1. Payment will be made only in Canadian currency unless otherwise specified herein and no interest will be paid on any sum overdue.

2. Materiel will be new production or current manufacture.

3. Cash discount time will be measured from the date invoice is received or date stores are delivered and accepted whichever is the later date.

4. a) The Contractor shall not invoice or collect any ad valorem sales tax levied by the province in which the goods or taxable services are delivered to federal government departments and agencies under authority of the following provincial sales tax licences:

Newfoundland	32243-0-09
Prince Edward Island	OP-10000-250
Nova Scotia	U84-00-03172-3
New Brunswick	P87-60-01648
Quebec	Q-398-SS-3921-1-P
Ontario	11708174G
Manitoba	390516-O

In all other provinces provincial sales taxes do not apply to goods or services delivered to federal government departments under this contract.

The contractor is not relieved of any obligation to pay provincial sales taxes on goods or taxable services he uses or consumes in the performance of this contract.

b) Provincial gallonage taxes on liquid fuels are to be charged on deliveries in Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario. In other provinces, these taxes are not applicable.

5. The provisions of General Conditions DSS 1026A in the case of requirements being provided on behalf of the Department of National Defence, or General Conditions DSS 1026 (S100A) in the case of all other requirements, (copies of which the Seller acknowledges to have received) shall form part of the contract except for a United States Seller in which case General Conditions DSS 1011A (United States Purchases), a copy of which the Seller acknowledges to have received, will apply.

6. Where no other packaging is specified, the following shall apply.

a) The supplies provided under the terms of this contract shall be so packed as to permit the application of the lowest transportation rates or charges via the mode of carriage selected/authorized.

b) For Department of National Defence requirements:
"*PREPARATION FOR DELIVERY.* If performed in Canada, shall be in accordance with the latest issue of the Canadian Forces Transportation Packaging Order CC-CIV-PACK (CFTPO-CC-CIV-PACK). If performed in the USA, preservation, packaging and packing shall be to level C as defined in the latest issue of Federal Standard No. 102 (Fed. Std. 102) and marking shall be in accordance with the latest issue of Federal Standard no. 123 (Fed. Std. 123). If performed in the U.K., preservation, packaging and packing shall be manufacturer's Trade Export Packaging or such packaging of a higher grade as recommended by the British Ministry.

7. Prices include packing, cartage and loading charges and all delivery charges to the destinations (F.O.B. point) specified, unless otherwise detailed herein.

8. Should the contractor prepay transportation charges which are payable by Her Majesty under the terms of this contract, these charges are to be shown as a separate item on the invoice.

9. The transportation bill of lading must accompany original invoice, except for "collect" shipments, in which event it shall accompany the shipment.

10. If transportation charges are payable by Her Majesty under the terms of this contract,

a) shipments are to be made by the most direct and economical means of transportation consistent with normal shipping practice, unless otherwise directed,

b) and if a declaration as to value of the shipment is required by the carrier then;
  (i) If the true value is less than the maximum liability of the carrier at minimum rates, true value shall be declared; or
  (ii) If the true value equals or exceeds the maximum liability at minimum rates, the true value shall be declared as "at least" equal to such maximum liability.

PACKING SLIPS

11. Packing slips must show item, quantity, part or reference numbers, description of supplies and contract reference numbers.

12. A packing slip must accompany each shipment and shall be enclosed either in a waterproof envelope fastened to the last package of the shipment, or inside the last package, which shall be marked to indicate the enclosures, or in the case of a carload shipment, shall be fastened to the inside door frame of the railway car.

13. If the supplies have been inspected at Contractor's plant, signed inspection voucher must be attached to the packing slip normally enclosed in the packing note envelope.

INVOICES

14. Invoices must be submitted in the name of the Contractor.

15. Invoices are not to be submitted prior to shipment of supplies, but must be submitted not later than the day following shipment, and as directed on the face hereof.

16. Invoices must show item, quantity, part or reference numbers, description of supplies as shown in this contract and contract reference numbers.

17. Separate invoices must be submitted for each shipment and must apply on one contract only.

18. Each invoice must indicate whether it covers partial or final shipment.

19. When mailing invoice, please mark envelope "INVOICES".

20. The name and address of the consignee must be shown on all invoices, together with date, method of shipment and the case numbers if applicable.

21. Terms of payment MUST be shown on all invoices.

CONDITIONS

1. Le paiement sera effectué uniquement en devises canadi[illegible] indication contraire portée dans les présentes, et aucun intérêt [illegible] versé sur un montant échu.

2. Les articles seront issue d'une production courante.

3. La période de l'escompte de caisse sera calculée à compter de la date de réception des factures ou de la date où les biens auront été livrés et acceptés, en prenant celle des deux qui est postérieure à l'autre.

4. a) L'entrepreneur ne facturera ni ne percevra de taxe de vente ad valorem imposée par la province où les biens ou services taxables sont livrés aux ministères fédéraux et leurs organismes, en vertu des permis provinciaux de taxe de vente suivants

Terre-Neuve	32243-0-09
Île-du-Prince-Édouard	OP-10000-250
Nouvelle-Écosse	U84-00-03172-3
Nouveau-Brunswick	P87-60-01648
Québec	Q-398-SS-3921-1-P
Ontario	11708174G
Manitoba	390516-O

Dans toutes les autres provinces, les taxes provinciales de vente ne s'appliquent pas aux biens et services livrés aux ministères fédéraux en vertu du présent contrat.

La présente clause ne modifie en rien l'obligation qu'a l'entrepreneur de payer les taxes de vente provinciales sur tous les biens et services taxables qu'il utilise ou consomme dans l'exécution du présent contrat."

b) Les taxes provinciales calculées au gallon sur le combustible liquide doivent être imputées lors des livraisons dans les provinces de Terre-Neuve, de l'Île-du-Prince-Édouard, de Nouvelle-Écosse, du Nouveau-Brunswick, de Québec et de l'Ontario. Dans les autres provinces, ces taxes ne sont pas applicables.

5. Les clauses de Conditions Générales, MAS 1026A, dans le cas de commandes passées au nom du ministère de la Défense nationale, ou les Conditions Générales MAS 1026 (S100A), pour toutes les autres commandes, (dont le vendeur reconnaît avoir reçu des exemplaires) formeront partie intégrante du présent contrat, sauf pour un vendeur des États-Unis dans ce cas, on appliquera les Conditions Générales MAS 1011A (Achats aux États-Unis), dont le vendeur reconnaît avoir reçu un exemplaire.

6. A défaut de spécifications concernant l'emballage, on devra se conformer aux règles suivantes:

a) Les fournitures à livrer aux termes du présent contrat doivent être emballées de façon à ce que le mode de transport choisi ou autorisé permette l'application des tarifs ou frais de transport minimum.

b) Fournitures commandées pour le ministère de la Défense nationale – "*PRÉPARATION POUR LA LIVRAISON*" s'il est effectué au Canada, l'emballage doit être conforme à l'édition la plus récente des Forces canadiennes sur le transport et l'emballage CC-CIV-PACK (OTEFC CC-CIV-PACK). S'ils sont effectués aux États-Unis, la conservation, l'emballage et l'empaquetage devront être de la catégorie C, définie par l'édition la plus récente de la Norme fédérale nº 102 (Fed. Std. 102) et le marquage devra être conforme à l'édition la plus récente de la Norme fédérale nº 123 (Fed. Std. 123). S'ils sont effectués au Royaume-Uni, la conservation, l'emballage et l'empaquetage devront être conformes à la norme d'emballage d'exportation du fabricant ou à toute autre norme d'emballage de haute qualité recommandée par le ministre britannique.

7. Les prix incluent les frais d'emballage, de transport, de chargement et tous les frais de livraison à destination (point f.à.b.), à moins d'indications contraires expressément portées par ailleurs dans le présent contrat

8. Si l'entrepreneur doit payer d'avance les frais de transport qui aux termes du présent contrat sont payables par sa Majesté, ces frais doivent être indiqués comme article particulier sur la facture.

9. Le connaissement doit accompagner l'original de la facture, sauf dans le cas d'envoie "en port dû", en quel cas il doit accompagner l'envoi

10. Si, aux termes du présent contrat, les frais de transport sont payables par sa Majesté,

a) les envois devront être effectués, sauf indication contraire, par la voie la plus directe et la plus économique selon les méthodes normales de transport.

b) et si le transporteur exige une déclaration visant la valeur de l'envoi, il faut alors;
  (i) Déclarer la valeur véritable, si elle est inférieure à la responsabilité maximum du transporteur au tarif minimum; ou
  (ii) Si la valeur véritable est égale ou dépasse la responsabilité maximum au tarif minimum, la déclarer comme étant "au moins" égale à cette responsabilité maximum.

FICHES D'EMBALLAGE

11. Les fiches d'emballage doivent indiquer l'article, la quantité, les numéros des pièces ou de renvoi, la désignation des articles et les numéros du contrat.

12. Une fiche d'emballage doit accompagner chaque expédition et doit être placée soit dans une enveloppe imperméable liée au dernier colis de l'envoi ou placée à l'intérieur du dernier colis, sur lequel on indiquera qu'il renferme la fiche ou, dans le cas d'une voiturée, la fiche sera attachée sur le cadre intérieur de la porte du wagon de chemin de fer

13. Si les articles ont été examinés à l'usine de l'entrepreneur, un certificat d'examen signé doit être annexé à la fiche d'emballage normalement incluse dans l'enveloppe destinée au billet d'emballage.

FACTURES

14. Les factures doivent être présentées au nom de l'entrepreneur

15. Les factures ne doivent pas être présentées avant l'envoi des articles, mais au plus tard le lendemain de l'envoi et de la façon indiquée au recto de la présente formule.

16. Les factures doivent indiquer l'article, la quantité, les numéros des pièces ou de renvoi, la désignation des articles telle qu'elle paraît dans le présent contrat et les numéros du contrat.

17. Des factures particulières doivent être présentées à l'égard de chaque envoi et doivent s'appliquer à un seul contrat.

18. Chaque facture doit indiquer si elle vise un envoi partiel ou l'envoi final.

19. Lorsque vous expédiez une facture, veuillez indiquer sur l'enveloppe le mot "FACTURE".

20. Le nom et l'adresse du destinataire doivent être indiqués sur toutes les factures, de même que la date, le mode d'expédition et les numéros des caisses s'il en est.

21. Les conditions de paiement DOIVENT paraître sur toutes les factures.

MONTHLY PROGRESS REPORTS

You shall prepare one (1) original and three (3) copies of a progress report at regular intervals of not less than once a month and forward the original and two (2) copies to the Scientific Authority and one (1) copy to the Senior Science Procurement Officer. The report shall be brief (in letter format) but shall include, as a minimum the following:

- a summary of work accomplished during the report period,
- a summary of work planned for the ensuing period,
- a statement as to whether the work is proceeding according to plan,
- identification of potential problem areas which may affect the progress of the work, and the proposed solutions to those problems,
- sufficient sketches, diagrams, photographs and discussion of progress and problems to allow the Scientific Authority and the Senior Science Procurement Officer, designated herein, to evaluate the progress of the work,

- Your Contract Plan showing the following:
  - actual and forecast expenditures on a monthly basis for the period of work being covered,
  - progress of the work against your Contract Plan,
  - instructions for showing the above on the Contract Plan are detailed in Appendix "B" attached.

  Your Contract Plan and Report Form will provide the basis for measuring the progress of the work and your performance under this contract.

Where a claim for progress payment is made, the monthly progress reports are to be submitted with, and are to support, your monthly claims for progress payment.

DELIVERABLE ITEMS:

1. Requirement for monthly progress reports is described separately in this contract.

2. Draft of the Final Report

   A draft of the final report, in accordance with Task 3 of the Statement of Work, shall be submitted for the approval of the Scientific Authority. The report will contain, as applicable, sketches, photographs and a discussion of the problems and successes associated with the work to enable a full and accurate evaluation of the work by the Scientific Authority. The report will be prepared in accordance with good engineering practices and will include as a minimum:

   (a) list of contents,
   (b) summary or abstract,
   (c) introduction,
   (d) complete description of the work undertaken,
   (e) technical discussion,
   (f) conclusions,
   (g) supporting graphs, tables and figures.

   The draft final report and the final reports shall contain an Executive Summary in both official languages of Canada.

3. Final Report:

   After approval of the draft final report, you shall submit the original and five (5) copies of a final report to the Scientific Authority.

DELIVERABLE ITEMS - CONTINUED

4. Each report is to contain a title page. The title page is attached as Appendix "C" to this contract.

5. A copy of the covering letter to the Scientific Authority accompanying the final report shall be submitted to the Senior Science Procurement Officer, designated herein.

6. Equipment

   You shall deliver the opacity meter to the Scientific Authority, designated herein, after completion of the project.

PROGRESS REVIEW MEETINGS

Progress review meetings will be held as and when considered necessary, at a time and place to be designated by the Scientific Authority.

SCIENTIFIC AUTHORITY

Dr. Horace Whaley
CANMET, Energy Research Laboratories
Department of Energy, Mines & Resources
555 Booth Street
Ottawa, Ontario
K1A 0G1
Telephone: (613) 993-7087

The Scientific Authority is responsible for all matters concerning the scientific and technological content of the work under this contract. Any proposed changes to the scope of the work are to be discussed with the Scientific Authority, but any resultant changes can only be authorized by a contract amendment issued by the Senior Science Procurement Officer.

SENIOR SCIENCE PROCUREMENT OFFICER

Dr. R.G. Agarwal
Science Branch
Science and Professional Services Directorate
Department of Supply and Services
11C1 Place du Portage, Phase III
11 Laurier Street
Hull, Quebec
K1A 0S5
Telephone Number:(819 or 613) 997-7420

The Senior Science Procurement Officer is responsible for the management of this contract and any changes to the contract must be authorized by a formal contract amendment issued by the Senior Science Procurement Officer. The Contractor is not to perform work in excess of or outside the scope of this contract based on verbal or written requests or instructions from any Government personnel other than the Senior Science Procurement Officer.

CONTINUATION

CONTRACT SERIAL NUMBER / NUMÉRO DE SÉRIE DU CONTRAT: 0SQ84-00423

DSS FILE NUMBER - NUMÉRO DU DOSSIER MAS: 06SQ.23440-4-9323

BASIS OF PAYMENT

You shall be paid in accordance with the following, subject to a limitation of expenditure of $252,000.00.

1. Labour - at hourly rates, inclusive of overhead, exclusive of profit or fee, calculated in accordance with the following formula	Est. $134,000.00
Hourly Rate for Engineering: actual annual salary multiplied by the firm multiplier of 0.0007161	
Hourly Rate for Plant and Trade: actual annual salary multiplied by the firm multiplier of 0.0006490	
2. Equipment - at laid down cost without mark-up: Opacity Meter	Est. $ 30,000.00
3. Consumable Materials from Stores - at cost plus 15% mark-up	Est. $ 5,000.00
i.e. lubricating oil, gaskets, replacement of parts consumed during the operation	
4. Travel and Living - at actual cost plus 15% mark-up, but not to exceed Treasury Board Travel Directive Guidelines current when incurred	Est. $ 14,000.00
5. Direct Charges - at laid down cost without mark-up	Est. $ 71,000.00
6. Credit for Energy - the net energy produced from the project	Est.($ 2,000.00)
TOTAL ESTIMATED COST SUBJECT TO A LIMITATION OF EXPENDITURE	$252,000.00

Direct Charges (item 5):

Rental of air compressors	Est. $15,000.
Bunker oil to support combustion	Est. $30,000.
Light oil (No.2) for light-off and running the air compressors	Est. $26,000.
Delivery of fuel, FOB Chatham plant from CBDC, Sydney, N.S.	No Charge

METHOD OF PAYMENT

Monthly progress payments will be made up to 100% of the amounts claimed, LESS credit for net energy produced, in accordance with the Basis of Payment, provided that:

a) the Contractor submits promptly to the Senior Science Procurement Officer a fully completed progress claim on Form DSS 1111 showing the following:

   i) charges for the work for the preceding period, supported by time sheets, receipt vouchers, etc.
   ii) LESS credit for net energy produced,
   iii) net amount payable after deduction of the credit.

A copy of form DSS 1111 is attached as Appendix "D".

b) the progress claim is accompanied by the required copies of progress reports;

c) the progress report is accepted by the Scientific Authority and the Senior Science Procurement Officer;

d) the progress claim is approved by the Scientific Authority and the Senior Science Procurement Officer.

The Contractor shall certify an original and four (4) copies of each claim and forward the original and three (3) copies to the Senior Science Procurement Officer, designated herein, and one copy to the Scientific Authority, designated herein.

Payments by Her Majesty to the Contractor for the work shall be made:

(a) In the case of a progress payment other than the final payment, within thirty (30) days following the date of receipt of a duly completed progress claim for DSS 1111;

(b) In the case of a final payment, within thirty (30) days following the date of receipt of a duly completed final progress claim form DSS 1111, or within thirty (30) days following the date on which the work is completed, whichever date is the later;

(c) If Her Majesty has any objection to the progress claim, within fifteen (15) days of its receipt, Her Majesty shall notify the Contractor of the nature of the objection.

Subject to:

(A) completion and acceptance of the work,

(B) the approval of the final claim by the Scientific Authority and by the Senior Science Procurement Officer,

(C) the submission of all deliverable items to the Scientific Authority,

(D) receipt by the Senior Science Procurement Officer of a certification made by an officer of the Contractor stating that all applicable disclosures of inventions were submitted or that there were no disclosures to submit under Section 14(2)(b) of General Conditions Research and Development DSS 9224 (4/84)

the final payment will be made to the Contractor.

CONTINUATION

CONTRACT SERIAL NUMBER
NUMÉRO DE SÉRIE DU CONTRAT
0SQ84-00423

DSS FILE NUMBER – NUMÉRO DU DOSSIER MAS
06SQ.23440 -4-9323

CONDITIONS PRECEDENT TO PAYMENT

No payment shall be made to the contractor unless or until:

a) invoices, inspection notes and all other documents prescribed from time to time by the Minister or inspector are submitted in accordance with the terms of the contract or instructions of the Minister;

b) with respect to all materials, parts, work in process or finished work, the cost of which has been paid by the Contractor and in respect of which payment is being made by the Minister, the Contractor, if required to do so, establishes to the satisfaction of the Minister that the materials, parts, work in process or finished work are free from all claims, liens, attachments, charges or encumbrances;

c) with respect to all materials, parts, work in process or finished work, the costs of which have accrued in the accounts of the Contractor as a liability to be discharged in the normal course of business and in respect of which materials, parts, work in process or finished work payment is being made by the Minister, the Contractor, if required to do so, establishes to the satisfaction of the Minister that it is not, in the ordinary course of business, delinquent in discharging its accrued liabilities arising from the performance of the contract and that the payment to be made by the Minister shall be used only for the purpose of discharging such liability and that upon such discharge the materials, parts, work in process or fnished work shall be free from all claims, liens, charges or encumbrances; and

d) in the case of payment in respect of finished work, such finished work has been inspected and accepted in accordance with the terms of this contract.

FUNDING BY FISCAL YEAR

Notwithstanding the price specified in the Basis of Payment, and unless otherwise authorized in writing by the Senior Science Procurement Officer, the maximum amount which may be paid, in the period ending March 31st of the year specified, is as follows:

1986 - $252,000.

INTEREST ON OVERDUE ACCOUNTS

A) i) In this Article an amount is "due and payable" when it is due and payable by Her Majesty to the Contractor according to the terms of the contract.

ii) For the purposes of this Article an amount is overdue when it is unpaid on the first day following the day upon which it is due and payable.

iii) In this Article "date of payment" means the day prior to the date of the negotiable instrument drawn by the Receiver General for Canada and given for payment of an amount due and payable.

iv) In this Article "Bank Rate" means the discount rate of interest set by the Bank of Canada.

B) i) Subject to the provisions of paragraph (C) hereof Her Majesty shall be liable to pay to the Contractor interest at the Bank Rate plus 1½ per centum on any amount which is overdue from the date such amount was overdue until the date of payment.

ii) The Bank Rate shall be that prevailing at the close of business on the date upon which the amount became overdue.

C) Her Majesty shall pay interest only if the Contractor, within ninety (90) days of the date of payment, claims payment for any interest owing to it by:

i) sending an invoice therefor in the manner set out in the Contract relating to invoices; or

ii) making a written request therefor to the Senior Science Procurement Officer.

D) Her Majesty shall not be liable to pay to the Contractor any interest on unpaid interest.

CONTINUATION

CONTRACT SERIAL NUMBER
NUMÉRO DE SÉRIE DU CONTRAT
0SQ84-00423

DSS FILE NUMBER - NUMÉRO DU DOSSIER MAS
06SQ.23440-4-9323

LIMITATION OF EXPENDITURE

Her Majesty's liability to you under this contract shall not exceed $252,000.00, sales tax included where applicable, unless otherwise authorized in writing by the Minister. You shall not be obliged to perform any work or services which would cause the total liability to Her Majesty to exceed the said sum, unless an increase is so authorized. You shall notify this Department as to the adequacy of this sum when it is 75% committed, or four months prior to the estimated date of completion of the contract, whichever comes first. However, if at any time you consider that the said sum may be exceeded, you shall promptly notify this Department.

No increase in the total liability of Her Majesty or in the price of the work or services resulting from any design change, modification or interpretation of the specifications, will be authorized or paid to you unless such design change, modification or interpretation shall have been approved, prior to being adopted by you in the work or services, by the Department of Supply and Services.

TIME VERIFICATION AND DISCRETIONARY AUDIT

Time charged may be verified by Government audit and a Government representative may also conduct a verification of the accuracy of the Contractor's time recording before or after total payment has been made to the Contractor. In addition the Government may conduct an audit to determine whether the profit margin of 0% which the Contractor has certified as being included in the price has been substantially exceeded. The cost reimbursable elements detailed in the Basis of Payment may be verfied by Government audit.

The Contractor warrants that the Statement of Canadian Content is true, correct and complete, and in accordance with the CGSB Standard for Definition of Canadian Content. Furthermore, the Contractor acknowledges that the Minister has relied upon such representations of Canadian content in entering into this contract and that this covenant may be subject to such verification as the Minister deems advisable.

Any payments made pending completion of the audit shall be regarded as interim payments only and shall be adjusted to the extent necessary to reflect the result of the said audit, and if there has been any overpayment it shall be promptly refunded to Her Majesty.

Supporting information for each element must be available and be in sufficient detail that an in-depth audit can be carried out.

CONTINUATION

CONTRACT SERIAL NUMBER
NUMÉRO DE SÉRIE DU CONTRAT
0SQ84-00423

DSS FILE NUMBER – NUMÉRO DU DOSSIER MAS
06SQ.23440-4-9323

GENERAL CONDITIONS

The terms and conditions of General Conditions Research and Development DSS 9224 (4/84), as amended below, in lieu of General Conditions DSS 1026 (S-100A) referred to on the reverse of Page 1, shall apply to and form part of this contract.

Article 11 of the Terms and Conditions DSS 9224 is hereby supplemented by adding the following sentence to subsection 1:

For work requiring consent, should the Contractor propose to solicit bids from other than Canadian sources he shall obtain the consent in writing of the Minister prior to solicitation.

Paragraph (b) of subsection 2 of Article 21 of Terms and Conditions DSS 9224 is deleted in its entirety and the following is substituted therefor:

(b) the Work or any portion of the Work is terminated, the Contractor shall be paid for all finished deliverables, delivered and accepted and for all materials or work-in-process delivered and acceptable to Her Majesty. The Contractor shall also be entitled to be reimbursed its costs which are incidental to the cancellation of obligations incurred by the Contractor pursuant to the termination notice, the cost of preparing the necessary accounts and statements with respect to the Work performed to the effective date of such termination and commitments made by the Contractor with respect to the Work performed to the effective date of such termination and commitments made by the Contractor with respect to the terminated portion of the Work, wages which the Contractor is obliged under any laws or regulations for the time being in force, to pay employees whose services are no longer required by reason of such termination, the costs of and incidental to the taking of any inventory of materials, components, work-in-process and finished work on hand at the effective date of the termination and other costs and expenses of and incidental to the termination in whole or in part, of operations under the Contract; provided always that payment and reimbursement under the provisions of this sub-section shall be made only to the extent that is established to the satisfaction of the Minister that the said costs and expenses were actually incurred by the Contractor and that the same are reasonable and are properly attributable to the termination of the Work or the part thereof so terminated.

(c) In no event shall the aggregate of the price paid to date and the amounts payable pursuant to this Article exceed the total Contract Price.

(d) The Contractor shall have no claim for damages, compensation, loss of profit, allowance or otherwise by reason of or directly or indirectly arising out of any action taken, or notice given by the Minister under or pursuant to the provisions of this Article except as and to the extent in this Article expressly provided.

APPENDIX "A"

TITLE: COMBUSTION TESTING OF CERAMIC COAL-WATER FUEL (CWF) ATOMIZERS IN UNIT NO.1 CHATHAM, NEW BRUNSWICK, GENERATING STATION

The Department of Energy, Mines and Resources has been supporting the development of coal-water fuels as an alternative coal combustion technology since 1978. Two boilers at the Chatham GS have been converted to CWF firing as part of this development program. A major effort has been placed on the development of abrasive wear resistant atomizers having reasonable (≈ 2000h) life with acceptable combustion performance. CANMET has been involved, together with the National Research Council in the development of a ceramic atomizer that has been tested briefly at the 40 GJ/h capacity in a single burner test in Unit No. 1 at the Chatham G.S. It is the intention of this contract to carry the full load on the boiler (10 MW(e)) using 3 or 4 of the ceramic atomizers and to conduct boiler performance evaluations at various loads. This is a prerequisite step to commercialization of the atomizer by the N.R.C.

Statement of Work

Task 1: Procurement of Fuel

You will obtain sufficient carbogel CWF fuel (approx. 500 tonnes) to enable the Chatham Unit No. 1 to be operated for at least four weeks for burner and boiler optimization and performance testing and in sufficient time for a March/April 1985 test period.

Task 2: Boiler Preparation and Testing Unit No. 1

You will undertake to prepare Unit No. 1 for four weeks of CWF testing at various loads and for any burner optimization that may be necessary.

Task 3: Reporting

Within two months after completing task 2 you will provide the scientific authority with a draft final report which will include relevant boiler operating parameters during the test period including the optimization period. After review by the scientific authority five copies of the final report will be issued to the scientific authority.

Note: The Carbogel CWF transportation and cost is excluded from this contract.

The supply of the CWF atomizers is the responsibility of the Chemical Engineering Section, Chemistry Division N.R.C.

APPENDIX "B"

DSS-MAS 9143 (6/81)

CONTRACT PLAN AND REPORT FORM

Instructions to Contractor

This form serves a dual purpose; the first is for planning and estimating the work, and the second is for reporting actual progress against the plan during contract execution.

PROPOSED PLAN

Your work and cost plan must be prepared on this "Contract Plan and Report Form" DSS-MAS 9143-3 and must be submitted as part of your proposal. The plan shall demonstrate how you propose to execute the contract by subdividing the work into tasks and providing for each task an estimate of the cost and a schedule for completion. An example of a completed form is attached, (page I).

Use additional pages if the number of tasks exceed 15, or if the contract duration will exceed 12 months. For high value contracts in excess of $1M you are required to subdivide the work into major tasks which in turn are to be subdivided into minor tasks, e.g. a system is divided into subsystems which in turn are divided into subtasks, such as subsystem components.

You will be required to revise your plan to reflect the results of the contract negotiation. The revised plan will form part of contract.

REPORTING PROGRESS

Following contract award, monthly progress reports which record actual start dates and projected completion dates by task, actual cost by task, actual cost by month, Estimate to Complete (E.T.C.) by task and E.T.C. by month are to be prepared and submitted in accordance with the attached example, (page II), unless otherwise noted in the contract.

NOTE: The contract file number, serial number and the actual months duration are to be entered in the appropriate blocks of the first and subsequent reports. The report period is to be indicated by drawing a solid vertical line at the end of the applicable month. Your progress report must be completed to the satisfaction of the Science Procurement Manager before progress claims will be processed for payment.

The following points concerning the attached example should be noted:

1) Reports actual progress to the end of August.
2) Actuals by month are recorded on the bottom line at the left of the date line and Estimate to Complete by month to the right of the date line.
3) MECHANICAL SUBSYSTEM Material Procurement started one month late, is projected to be completed on time, has cost $4M and the Estimate to Complete is $1M. Total subtask is expected to cost $5M.
4) MECHANICAL SUBSYSTEM Assembly is expected to start one month late and to be completed one month late. The expected late completions are to be highlighted using broken lines.
5) ELECTRICAL SUBSYSTEM Assembly started one month early and is expected to be completed one month early.
6) DISPLAY CONTROL SUBSYSTEM Procurement is 50% complete in terms of cost. The estimated completion date has slipped 2 months.
7) SYSTEM INTEGRATION AND SYSTEM TEST are both expected to start one month late reflecting the one month delay in MECHANICAL SUBSYSTEM Fabrication and Assembly.
8) As of the end of August, the total contract cost is expected to be $26M ($12.7M Actual plus $13.3M E.T.C.) or to equal the planned cost of $26M. The contract is expected to be completed one month later than planned.

FORMULE DE PROJET DE CONTRAT ET RAPPORT

Instructions aux entrepreneurs

Cette formule a un double but; elle sert premièrement à planifier et estimer le travail, et deuxièmement, à vérifier, tout au long de l'exécution du contrat, si les travaux se déroulent selon le plan.

PLAN PROPOSÉ

Les plans concernant les travaux et les coûts prévus doivent être établis sur la "Formule de projet de contrat et de rapport" DSS-MAS 9143-3 et doivent être présentés comme faisant partie de votre proposition. Le plan doit faire état de la facon dont vous prévoyez mettre le contrat à exécution en divisant le travail en tâches et en donnant, pour chaque tâche, une estimation du coût et un calendrier d'exécution. Ci-joint à la page I un exemple de formule remplie.

Utilisez des pages additionnelles si le nombre de tâches dépasse 15 ou si la durée du contrat est de plus de douze mois. Pour les gros contrats d'une valeur supérieure à $1M, divisez le travail à accomplir en tâches principales que vous subdiviserez par la suite en tâches secondaires. Pensez, par exemple, à un système divisé en sous-systèmes, qui, à leur tour, sont subdivisés en sous-tâches, comme des composants du sous-système.

Vous devrez réviser votre plan pour tenir compte des résultats des négociations; le plan révisé fera partie du contrat.

RAPPORT DE SITUATION

Lorsqu'un contrat est adjugé, il faut remplir un rapport de situation mensuel indiquant la date à laquelle chaque tâche a été entreprise, ainsi que la date prévue d'achèvement de chaque tâche, la somme dépensée tous les mois pour chaque tâche et le coût prévu d'achèvement par tâche et par mois et présenter ce rapport de la façon indiquée à la page II ci-jointe, à moins qu'il n'en soit indiqué autrement dans le contrat.

NOTA: Le numéro de dossier du contrat, le numéro de série et la durée actuelle en mois doivent être inscrits dans les cases correspondantes du premier rapport et des rapports subséquents. La fin de la période visée par le rapport doit être indiquée au moyen d'un trait vertical plein après le mois en question. Le rapport de situation doit être jugé satisfaisant par le directeur de l'approvisionnement scientifique avant que les demandes d'accompte ne soient traitées.

Soulignons les points suivants en ce qui concerne l'exemple annexé:

1) Les progrès, y compris ceux accomplis à la toute fin du mois d'août, figurent sur le rapport.
2) Les coûts réels, par mois, figurent en bas, à gauche du trait vertical plein indiquant la fin de la période visée par le rapport; le coût prévu pour l'exécution complète, en bas, à droite du trait vertical.
3) Ainsi, on voit que l'achat de matériel pour le sous-système mécanique a commencé un mois en retard, qu'on prévoit qu'il sera terminé à la date prévue. Cette tâche a coûté jusqu'ici $4M et on prévoit qu'elle coûtera un autre million d'ici à la fin des travaux. On prévoit donc qu'en tout, cette tâche aura coûté $5M.
4) L'assemblage du sous-système mécanique commencera probablement un mois en retard et se terminera aussi un mois en retard. Il faut mettre en relief les retards prévus au moyen de pointillés.
5) L'assemblage du sous-système électronique a débuté un mois en avance et devrait être terminé un mois en avance.
6) L'achat du sous-système de contrôle de l'affichage est exécuté à 50% en ce qui touche les coûts. La date prévue d'achèvement a toutefois été reportée de deux mois.
7) L'intégration et les vérifications du système devraient commencer deux mois en retard à cause du retard accusé au niveau de la fabrication et de l'assemblage du sous-système mécanique.
8) À la fin du mois d'août, on prévoit que le coût total du contrat sera de $26M ($12.7M déjà engagés et une dépense de $13.3M de prévue), c'est-à-dire qu'il atteindra le coût de $26M. La date d'achèvement a toutefois été reportée d'un mois.

Supply and Services Canada   Approvisionnements et Services Canada

DSS-MAS 9143-1 (4/81)
Page 1

CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

CONTRACT TITLE – TITRE DU CONTRAT: GISMO DEVELOPMENT, ENGINEERING MODEL
CONTRACTOR – ENTREPRENEUR: ACME INDUSTRIES LTD.

FILE NO. – N° DU DOSSIER

SERIAL NO. – N° DE SÉRIE

TASK DESCRIPTION DESCRIPTION DE LA TÂCHE	TASK DURATION IN MONTHS – DURÉE DE LA TÂCHE EN MOIS												TASK COST – COÛT DE LA TÂCHE		
	1 MAY MAI	2 JUNE JUIN	3 JULY JUILLET	4 AUG. AOÛT	5 SEPT.	6 OCT.	7 NOV.	8 DEC. DÉC.	9 JAN. JANV.	10 FEB. FÉV.	11 MAR. MARS	12 APR. AVR.	PLANNED PRÉVU À L'ORIGINE	ACTUAL PRÉSENTEMENT	E.T.C. À VENIR
MECHANICAL SUBSYSTEM SOUS-SYSTÈME MÉCANIQUE													ALL NUMBERS IN MILLIONS TOUS LES CHIFFRES REPRÉSENTENT DES MILLIONS		
MATERIAL PROCUREMENT ACHAT DE MATÉRIEL	▬	▬	▬	▬	▬	▬							5M		
FABRICATION		▬	▬	▬	▬	▬							3M		
ASSEMBLY ASSEMBLAGE				▬	▬	▬	▬						2M		
ELECTRICAL SUBSYSTEM SOUS-SYSTÈME ÉLECTRIQUE															
MATERIAL PROCUREMENT ACHAT DE MATÉRIEL		▬	▬	▬									2,5M		
FABRICATION			▬	▬	▬								2,5M		
ASSEMBLY ASSEMBLAGE					▬	▬							1M		
DISPLAY, CONTROL SUBSYSTEM SOUS-SYSTÈME DE CONTRÔLE DE L'AFFICHAGE															
MATERIAL PROCUREMENT ACHAT DE MATÉRIEL	▬	▬	▬	▬									2M		
FABRICATION				▬	▬								2M		
ASSEMBLY ASSEMBLAGE					▬	▬							1M		
SYSTEM INTEGRATION INTÉGRATION DU SYSTÈME							▬	▬	▬				3M		
SYSTEM TEST VÉRIFICATION DU SYSTÈME										▬	▬		2M		
PLANNED COST BY MONTH COÛT PRÉVU POUR CHAQUE MOIS	1,5M	3,1M	3,6M	5,1M	5,1M	2,1M	1,5M	1M	1M	1M	1M		PLAN 26M	▨	▨
ACT. PRÉSEN. — E.T.C. BY MONTH PRÉVISION POUR CH. MOIS													▨	ACTUAL COÛTS RÉELS	E.T.C. À VENIR

Supply and Services Canada   Approvisionnements et Services Canada

DSS MAS 9143-2 (4/

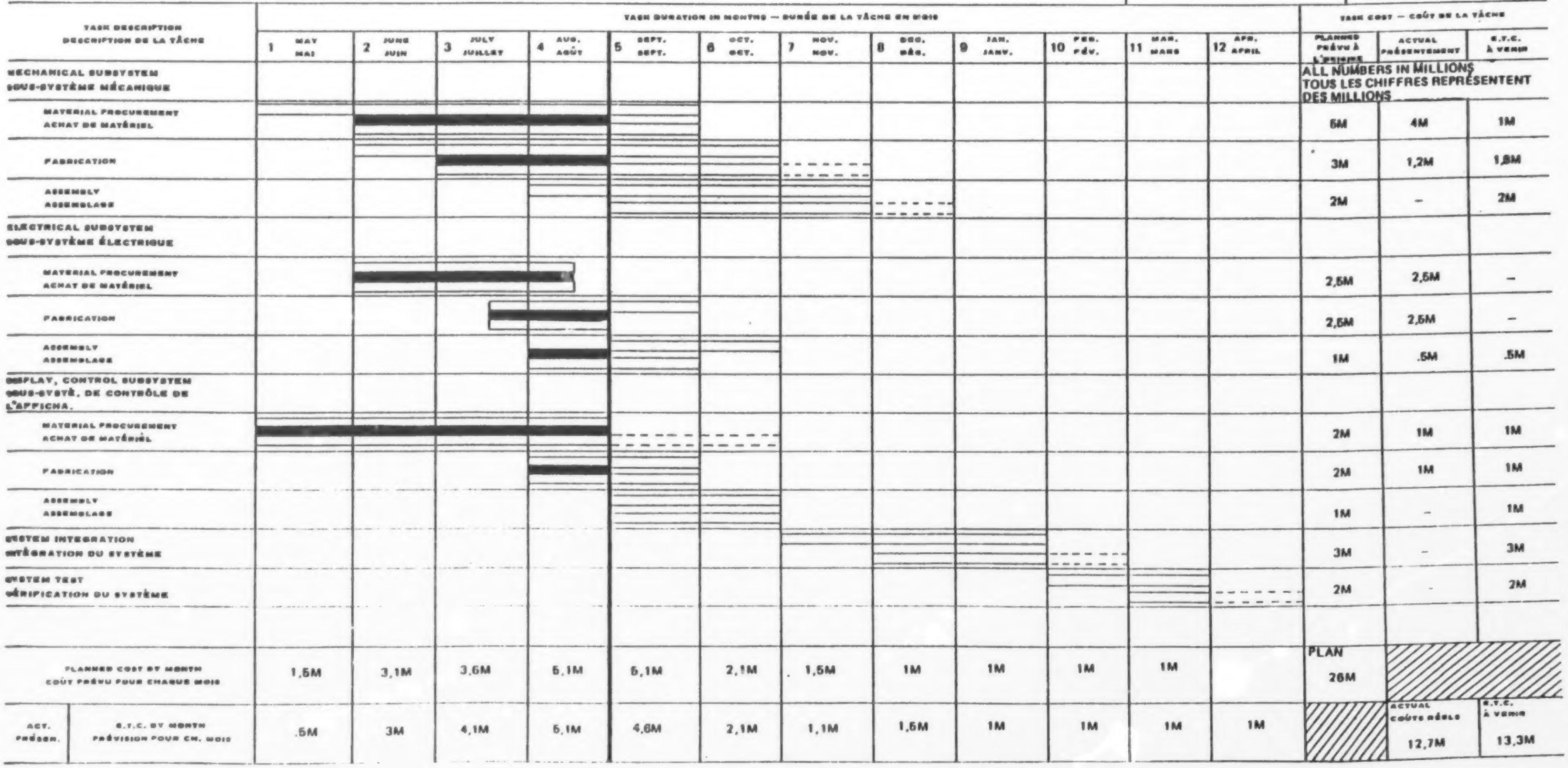
Page II

CONTRACT PLAN AND REPORT FORM — FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

CONTRACT TITLE — TITRE DU CONTRAT: GISMO DEVELOPMENT, ENGINEERING MODEL
CONTRACTOR — ENTREPRENEUR: ACME INDUSTRIES LTD.

FILE NO. — Nº DU DOSSIER

SERIAL NO. — Nº DE SÉRIE



TASK DESCRIPTION DESCRIPTION DE LA TÂCHE	TASK DURATION IN MONTHS — DURÉE DE LA TÂCHE EN MOIS												TASK COST — COÛT DE LA TÂCHE		
	1 MAY MAI	2 JUNE JUIN	3 JULY JUILLET	4 AUG. AOÛT	5 SEPT. SEPT.	6 OCT. OCT.	7 NOV. NOV.	8 DEC. DÉC.	9 JAN. JANV.	10 FEB. FÉV.	11 MAR. MARS	12 APR. APRIL	PLANNED PRÉVU À L'ORIGINE	ACTUAL PRÉSENTEMENT	E.T.C. À VENIR
MECHANICAL SUBSYSTEM SOUS-SYSTÈME MÉCANIQUE													ALL NUMBERS IN MILLIONS TOUS LES CHIFFRES REPRÉSENTENT DES MILLIONS		
MATERIAL PROCUREMENT ACHAT DE MATÉRIEL													5M	4M	1M
FABRICATION													3M	1,2M	1,8M
ASSEMBLY ASSEMBLAGE													2M	–	2M
ELECTRICAL SUBSYSTEM SOUS-SYSTÈME ÉLECTRIQUE															
MATERIAL PROCUREMENT ACHAT DE MATÉRIEL													2,5M	2,5M	–
FABRICATION													2,5M	2,5M	–
ASSEMBLY ASSEMBLAGE													1M	.5M	.5M
DISPLAY, CONTROL SUBSYSTEM SOUS-SYSTÈ. DE CONTRÔLE DE L'AFFICHA.															
MATERIAL PROCUREMENT ACHAT DE MATÉRIEL													2M	1M	1M
FABRICATION													2M	1M	1M
ASSEMBLY ASSEMBLAGE													1M	–	1M
SYSTEM INTEGRATION INTÉGRATION DU SYSTÈME													3M	–	3M
SYSTEM TEST VÉRIFICATION DU SYSTÈME													2M	-	2M
PLANNED COST BY MONTH COÛT PRÉVU POUR CHAQUE MOIS	1,5M	3,1M	3,6M	5,1M	5,1M	2,1M	1,5M	1M	1M	1M	1M		PLAN 26M		
ACT. PRÉSEN. — E.T.C. BY MONTH PRÉVISION POUR CH. MOIS	.5M	3M	4,1M	5,1M	4,6M	2,1M	1,1M	1,6M	1M	1M	1M	1M		ACTUAL COÛTS RÉELS 12,7M	E.T.C. À VENIR 13,3M

Supply and Services Canada
Approvisionnements et Services Canada

DSS-MAS 9143-3 (4/

CONTRACT PLAN AND REPORT FORM – FORMULE DE PROJET DE CONTRAT ET DE RAPPORT

CONTRACT TITLE – TITRE DU CONTRAT

CONTRACTOR – ENTREPRENEUR

FILE NO. – Nº DU DOSSIER	SERIAL NO. – Nº DE SÉRIE

TASK DESCRIPTION DESCRIPTION DE LA TÂCHE	TASK DURATION IN MONTHS – DURÉE DE LA TÂCHE EN MOIS												TASK COST – COÛT DE LA TÂCHE		
	1	2	3	4	5	6	7	8	9	10	11	12	PLANNED PRÉVU À L'ORIGINE	ACTUAL PRÉSENTEMENT	E.T.C. À VENIR
PLANNED COST BY MONTH COUT PRÉVU POUR CHAQUE MOIS													PLAN	▨	▨
ACT. PRÉSEN. E.T.C. BY MONTH PRÉVISION POUR CH. MOIS													▨	ACTUAL COÛTS RÉELS	E.T.C. À VENIR

Supply and Services Canada
Approvisionnements et Services Canada

CLAIM FOR PROGRESS PAYMENT
RÉCLAMATION DE PAIEMENT PARTIEL

USE SUPPLEMENTARY CLAIM FORM DSS-MAS 1112 AS REQUIRED TO RECORD DETAIL
AU BESOIN, INSCRIRE LES DÉTAILS SUR LA FORMULE DE RÉCLAMATION SUPPLÉMENTAIRE DSS-MAS 1112

ONTRACTOR - ENTREPRENEUR The New Brunswick Electric Power Commission	CLAIM NO. - Nº DE LA RECLAMATION	DATE

DDRESS - ADRESSE
515 King Street, Fredericton, N.B. E3B 4X1

ATURE OF WORK - NATURE DES TRAVAUX Combustion Testing of Ceramic Coal-Water Fuel (CWF) Atomizers in Unit No.1, Chatham, New Brunswick, Generating Station

ONT. FILE NO. - Nº DU DOSSIER DU CONT. 06SQ.23440-4-9323	SERIAL - SÉRIE	(FE/CD - FC/RN) (CF/DC - CF/NR)	CONTRACT PRICE - PRIX DU CONTRAT $252,000.

ONTRACTOR'S REPORT OF PROGRESS (IF MORE SPACE IS REQUIRED PLEASE USE SEPARATE SHEET)
OMPTE RENDU DES TRAVAUX PAR L'ENTREPRENEUR (SE SERVIR, AU BESOIN, D'UNE AUTRE FEUILLE)

ERIOD OF WORK COVERED BY THIS CLAIM ERIODE DE TRAVAIL VISÉE PAR LA PRÉSENTE DESCRIPTION: (EXPENDITURES ARE TO BE DETAILED BY LINE ITEM AS SPECIFIED IN THE CONTRACT, ISTING AS APPLICABLE TIME, LABOUR, MATERIAL, OVERHEAD, ETC. LESS HOLDBACK(S)). DESCRIPTION: (VENTILER LES DÉPENSES PAR POSTES COMME STIPULÉ DANS LE CONTRAT, C.-A-D. NSCRIRE SELON LE CAS, LES HEURES, LA MAIN-D'OEUVRE, LE MATÉRIEL, LES FRAIS GÉNÉRAUX, ETC. MOINS ES RETENUES)	CURRENT CLAIM RÉCLAMATION ACTUELLE $	¢	PREVIOUS CLAIM RÉCLAMATION PRÉCÉDENTE $	¢	TOTAL TO DATE TOTAL A CE JOUR $	¢
TOTAL ►						
LESS HOLDBACKS - MOINS LES RETENUES ►						
CLAIM - RÉCLAMATION TOTAL ►						

URRENT ESTIMATED COST TO CONTRACT COMPLETION BY GOVERNMENT FISCAL YEAR. OÛT TOTAL PRÉVU, PAR ANNÉE FINANCIÈRE DU GOUVERNEMENT, D'ICI LA FIN DU CONTRAT.	DEDUCT, PREVIOUS CLAIMS DÉDUIRE LA SOMME DES RÉCLAMATIONS PRÉCÉDENTES	
	AMOUNT DUE MONTANT DÛ	
	PERCENTAGE OF THE WORK COMPLETED POURCENTAGE DU TRAVAIL EXÉCUTÉ	%

ALL CERTIFICATES APPEARING ON THE REVERSE MUST BE SIGNED BY THE RESPECTIVE AUTHORIZED SIGNATORY

TOUTES LES ATTESTATIONS AU VERSO DOIVENT PORTER LA SIGNATURE DU FONDÉ DE POUVOIR

SS-MAS 1111 (5/83)

and Services Approvisionnements et Services
Canada

X

SUPPLEMENTARY CLAIM – DEMANDE COMPLÉMENTAIRE

To be used for recording costs in support of progress payment, Form DSS 1111
À employer pour énumérer les frais à l'appui de la demande de paiement partiel, Formule MAS 1111

DATE
PAGE OF DE
CLAIM NUMBER — Nº DE LA DEMANDE

ONTRACTOR - ENTREPRENEUR
The New Brunswick Electric Power Commission

ONTRACT FILE NUMBER — Nº DE RÉF. DU CONTRAT
06SQ.23440-4-9323

SERIAL — SÉRIE

(PE/CD-CP/DC)-(PC/RH-CP/HR)

DESCRIPTION	CURRENT CLAIMS DEMANDES ACTUELLES		PREVIOUS CLAIMS DEMANDES PRÉCÉDENTES		TOTAL TO DATE TOTAL À CE JOUR	
	$	¢	$	¢	$	¢
TOTAL ▶						

DSS-MAS 1112

Canada

DSS File No. 06SQ.23440-4-9323
Contract Serial No.

Page 1 of 1

APPENDIX "C"

SAMPLE TITLE PAGE

TITLE: COMBUSTION TESTING OF CERAMIC COAL-WATER FUEL (CWF) ATOMIZERS IN UNIT NO.1, CHATHAM, NEW BRUNSWICK, GENERATING STATION

Final Report
by:

Work on the project was conducted under the auspices of the Canada Centre for Mineral and Energy Technology, Energy, Mines and Resources Canada.

DSS File No. 06SQ.23440-4-9323

DSS Contract Serial No.

CANMET Project No.

CANMET Scientific Authority: Dr. H. Whaley

Date:

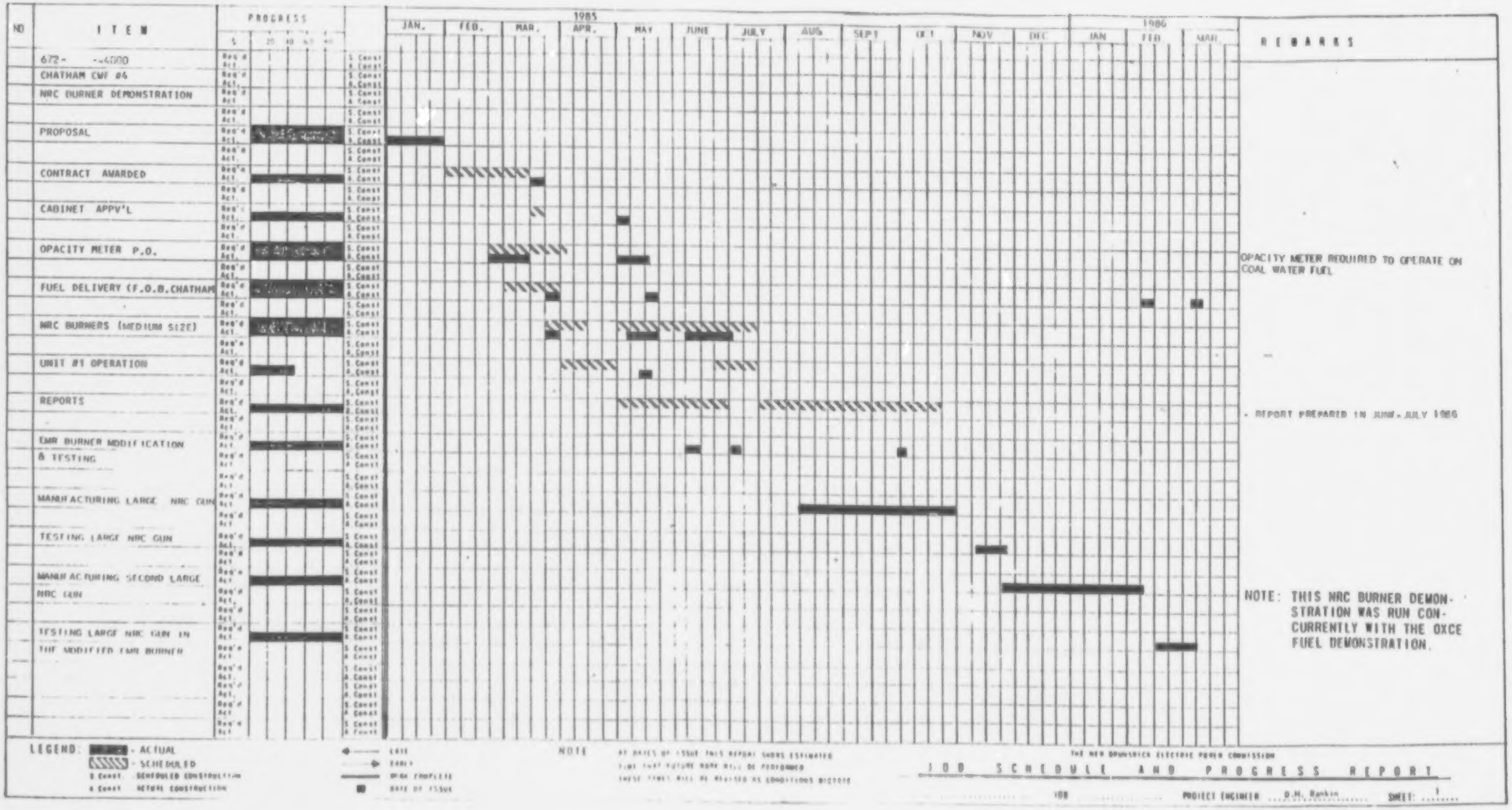
N.R.C. BURNER DEMONSTRATION
AT
NB POWER'S CHATHAM T.G. STATION

SECTION 16.2

PROJECT SCHEDULE
AND
LIST OF EVENTS

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

JOB SCHEDULE AND PROGRESS REPORT



OPACITY METER REQUIRED TO OPERATE ON COAL WATER FUEL

- REPORT PREPARED IN JUNE-JULY 1986

NOTE: THIS NRC BURNER DEMONSTRATION WAS RUN CONCURRENTLY WITH THE OXCE FUEL DEMONSTRATION.

NOTE AT DATES OF ISSUE THIS REPORT SHOWS ESTIMATED TIME THAT FUTURE WORK WILL BE PERFORMED THESE TIMES WILL BE REVISED AS CONDITIONS DICTATE

JOB .... PROJECT ENGINEER ....D.M. Rankin.... SHEET: ...1...

NRC Burner Test - CWF 4 | OXCE Fuel Test - CWF 3

- The Unit No.1 boiler developed a leak when it was being brought up to operating conditions.
- The NRC people arrived on site to start the test program.

Nov.13 - The NRC people left the Chatham Plant because once the boiler repair had been completed, there would not have been sufficient time to do any testing that week.

Nov.14 - Unit No.1 boiler repair completed.

Nov.18 - Unit No.1 in-service burning the reworked fuel with the Forney guns.

Nov.19 - The NRC people returned to the Chatham Plant.

Nov.20 - NRC gun/atomizer test started.
- The first rail car of fuel was burnt by the evening.
- Good flames with the NRC guns.

Nov.21 - The second car of partly reworked fuel had been unloaded overnight.
- Good flames with both of the NRC guns.
- The C-13 stabilizer was added in the evening to the remaining fuel in the bunker.

Nov.22 - Poor fires with both the NRC and Forney guns, support ignition had to be used.

Nov.23 - The second rail car of fuel was burnt by late in the day.

NRC Burner Test - CWF 4

OXCE Fuel Test - CWF 3

Nov.24 - The third rail car of fuel, with all the fuel additives in it, was unloaded overnight.
- Poor fires with the NRC guns and support ignition had to be used.

Nov.25 - Unit No.1 was in-service until 1:50 a.m. Tuesday, Nov.25 to burn the remaining fuel, and to obtain the maximum number of operating hours on the NRC atomizers.
- As this third car of reworked fuel was burnt, the fires started to improve. This was due to the fuel improving with age and receiving more mixing.
- This completed this phase of the NRC test program.

HISTORY OF C.W.F. FUEL AND BURNER TESTING
Summer/Fall 1985

NRC Burner Test - CWF 4

April - Preparation for NRC Test Program.

April 19 - Carbogel (CWF) Fuel left Sydney, N.S.

April 25 - 3 rail cars of CWF from Sydney arrived at the Chatham Plant.

May 13 - NRC on site in Chatham to start their burner test program.

May 14 - Water spray test on new burner/atomizers.

May 15 - Further burner testing.
- NRC left site.

May 31 - Opacity meter installed and commissioned.

June 4 - Reviewed, Unit No. 1 Burner No. 1 throat modifications requested by NRC.

June 5 - Carbogel - CWF starting to settle in bunker.

June 7 - Burner No. 1 throat modified so that the Primary and Secondary would mix before reaching the atomizer tip.

June 8 - Water spray test on the modified No. 1 burner.

June 14 - The shape of Burner No. 1 throat changed by the addition of refactory.

June 18 - NRC returned to Chatham to test the reshaped No. 1 burner throat.
- The large NRC gun would only give a load of $25x10^6$ BTU - less than half the required load.

OXCE Fuel Test - CWF 3

Unit No. 2 out of service while C.E. Canada/KDL rebuilt their burners and atomizer.

HISTORY OF C.W.F. FUEL AND BURNER TESTING
Summer/Fall 1985

NRC Burner Test - CWF 4	OXCE Fuel Test - CWF 3
June 22 - NRC left Chatham.	
	June 25 - KDL on site to check the Unit No. 2 ignitors.
	- Six cars of OXCE fuel (CWF) shipped from Jacksonville, Florida.
July 3 - EMR/NRC returned to Chatham to test a new deflector on the gun in the No. 1 modified burner throat, and test a new swirler in Burner No. 4.	
July 5 - Second shipment of 3 rail cars of carbogel (CWF) received from Sydney.	
- EMR/NRC left Chatham.	
July 8 - Project review meeting at NRC office in Ottawa.	
- NRC will build a larger CWF gun/atomizer with a capacity of 55 x 10^6 BTU.	
	July 15 - CE/KDL on site to install their modified burner/atomizers.
July 16 - Carbogel (CWF) in the bunker is settling.	July 16 - OXCE Fuel (CWF) arrived in Chatham/Newcastle.
July 19 - Stabilizer recieved and added to CWF in bunker.	
	July 20 - CWF burner front supply pumps relocated.
July 22 - Fuel sterilizer received and added to CWF in bunker.	

HISTORY OF C.W.F. FUEL AND BURNER TESTING
Summer/Fall 1985

NRC Burner Test - CWF 4	OXCE Fuel Test - CWF 3
	July 23 - Unit No.2 boiler ready but the new C.E. atomizer tips did not arrive in Chatham until late on July 23. It was late in the evening before a CWF gun was in service burning carbogel (CWF).
	July 24 - Unit No.2 unavailable because of boiler feed pump problems.
	July 25 - Boiler feed pump repair completed but Unit No.2 could not be in service before 6:00 p.m. because of a lack of water.
	July 26 - More testing done on one modified CWF gun. - CE and KDL people left site.
July 30 - More problems with the settling of the carbogel in the bunker.	
	Aug. 6 - Unit No.2 on line to burn up the carbogel (CWF) in the bunker.
	Aug. 7 - The water level in the Unit No.2 boiler drum went too high, which allowed wet steam to go to the turbine, and the unit tripped.
Aug. 12 - Unit No.1 in service to burn up the CWF fuel (carbogel) in the bunker.	Aug. 12 - Inspection of turbine completed - the unit will be out of service for 4 weeks.

NRC Burner Test - CWF 4

Aug. 16 - All CWF in bunker burnt and piping flushed out.

Mid Aug. to late Sept. the new and larger N.R.C. gun was being manufactured.

OXCE Fuel Test - CWF 3

Aug. 29 - 62.4 tons of OXCE fuel unloaded from one rail tank car.

- 12 to 18 inches of settled CWF remained in the bottom of the car.

Aug. 30 - 24.6 tons of OXCE fuel burnt in Unit No. 1.

Sept. 6 - Remainder of OXCE fuel in the bunker burnt in Unit No. 1.

Sept. 9 - Agreed with OXCE - their fuel will have to be replaced before a meaningful test can be conducted in Unit No. 2.

Sept. 11 - Second car of OXCE fuel being unloaded.

Sept. 12 - Unit No. 1 out of service while the cooling water channel was being inspected.

Sept. 16 - Unit No. 1 in service burning OXCE fuel

Sept. 17 - Unit No. 1 out of service because the power supply to the tank farm was cut accidently by the Unit No. 3 construction.

HISTORY OF C.W.F. FUEL AND BURNER TESTING
Summer/Fall 1985

NRC Burner Test - CWF 4		OXCE Fuel Test - CWF 3	
		-	3 rail cars released for return to OXCE.
		Sept. 18 -	Unit No. 1 still out of service.
		Sept. 20 -	Unit No. 1 in service but had to be shut down because of weather.
Sept. 25 -	The carbogel in the three rail cars was tested in Chatham and found to be in good condition.	Sept. 25 -	Unit No. 2 boiler was in service to dry out the new insulation on the turbine but had to be shut down due to a tube leak.
		Sept. 27 -	Again the No. 2 boiler had to be shut down with a second tube leak.
Sept. 30 -	NRC arrived in Chatham to test their new larger gun.	Sept. 30 -	Repairs completed and Unit No. 2 in service to commission the turbine.
Oct. 1 -	New NRC gun installed in Unit No. 1 boiler and some carbogel fuel unloaded.	Oct. 1 -	C.E. Canada were told N.B. Power is ready to resume testing in Unit No. 2 with OXCE fuel.
-	The carbogel in the three rail cars was found to be settling.		
Oct. 2 -	Preliminary testing done on the new NRC gun/atomizer.		
Oct. 3 -	Unit No. 1 shut down because of a tube leak. N.R.C. left Chatham.		
		Oct.7 -	OX-CE fuel (partly settled) was unsuccessfully tested in Unit No.2.

NRC Burner Test - CWF 4

OXCE Fuel Test - CWF 3

Oct.9/10 - Greg Dubien of OX-CE on site in Chatham to check fuel.

Oct.11 - Greg Dubien reported chemicals will be sent to Chatham to treat the OX-CE fuel in the Chatham bunker.

Oct.15-18 - OX-CE personnel on site to re-work their fuel and burn it in Unit No.2. There was a large amount of fall out and high opacity during the burning of the 70 tons of re-worked OX-CE fuel.

Oct.21 - OX-CE said they will not be sending new fuel to Chatham and will be re-working the fuel on site.

Oct.28 - OX-CE personnel returned to Chatham to re-work some of their fuel now on site ready for the burning test. All day was spent mixing one car of fuel to get the coal back into suspension.

Oct.29 - One rail car of OXCE fuel was unloaded into the in-plant storage bunker and new chemicals added.

NRC Burner Test - CWF 4

*Note:
With Unit No. 1 boiler fans in Operation this opacity would be reduced to 37% at the discharge to boiler stack.

OXCE Fuel Test - CWF 3

Oct.30 - Two CWF guns in-service burning OXCE fuel with support ignition. The opacity readings were high. - For 45 minutes one CWF gun was run successfully with steam atomization before the gun plugged with fuel that had dried in the gun and atomizer tip.

Oct.31 - After operating for some time three CWF guns were in-service with stable fires burning OXCE fuel with no ignitors, and one heavy fuel oil gun at half load. The opacity reading at the meter was close to 50%,* after the burners had settled down. Therefore it was concluded there was no way four CWF guns at full, without support ignition, could be in-service with an acceptable opacity level in this unit.

Nov.1 - Unit No. 2 in-service with two heavy oil guns at half load, and two CWF guns with OXCE fuel at full load and light oil

	NRC Burner Test - CWF 4	OXCE Fuel Test - CWF 3
		ignitors to burn out the remaining OXCE fuel in the in-plant sorage bunker. Good stable fires were obtained (with support ignition). - The one empty and two full rail cars of settled OXCE fuel were returned to OXCE Fuel Co., in Jacksonville, Florida. - This completed the test program for the "OXCE" fuel and new "CE" burners.
Nov.4 -	Work started on remixing the three rail cars of carbogel fuel in Chatham, and getting ready for the retesting of the larger NRC-CWF guns.	
Nov.5-21 -	Problems were experienced in obtaining the required fuel additives from CBDC in Sydney, N.S., and A.B.Carbogel in Sweden.	
Nov.7 -	One rail car of remixed (but unstable) carbogel fuel unloaded. - A small amount of fuel additive C-13 (stabilizer) which the Chatham Plant had on hand was added to the fuel.	
Nov.12 -	The one rail car of CWF had been recirculated in the bunker over the long weekend. - Still no word from CBDC/A.B.Carbogel when the required chemical additives will be shipped to Chatham.	

NRC Burner Test - CWF 4 | OXCE Fuel Test - CWF 3

- The Unit No.1 boiler developed a leak when it was being brought up to operating conditions.
- The NRC people arrived on site to start the test program.

Nov.13 - The NRC people left the Chatham Plant because once the boiler repair had been completed, there would not have been sufficient time to do any testing that week.

Nov.14 - Unit No.1 boiler repair completed.

Nov.18 - Unit No.1 in-service burning the reworked fuel with the Forney guns.

Nov.19 - The NRC people returned to the Chatham Plant.

Nov.20 - NRC gun/atomizer test started.
- The first rail car of fuel was burnt by the evening.
- Good flames with the NRC guns.

Nov.21 - The second car of partly reworked fuel had been unloaded overnight.
- Good flames with both of the NRC guns.
- The C-13 stabilizer was added in the evening to the remaining fuel in the bunker.

Nov.22 - Poor fires with both the NRC and Forney guns, support ignition had to be used.

Nov.23 - The second rail car of fuel was burnt by late in the day.

NRC Burner Test - CWF 4		OXCE Fuel Test - CWF 3
Nov. 24	- The third rail car of fuel, with all the fuel additives in it, was unloaded overnight. - Poor fires with the NRC guns and support ignition had to be used.	
Nov. 25	- Unit No. 1 was in-service until 1:50 a.m. Tuesday, Nov. 25 to burn the remaining fuel, and to obtain the maximum number of operating hours on the NRC atomizers. - As this third car of reworked fuel was burnt, the fires started to improve. This was due to the fuel improving with age and receiving more mixing. - This completed this phase of the NRC test program.	
Dec/85 - Mid-Feb/86	- NRC manufactured a second large gun/atomizer. - NB Power installed a pilot test baghouse on the roof of the Chatham, Unit No. 1 boilerhouse.	
Feb. 14	- The first truck load of new CWF arrived at the Chatham Plant.	
Feb. 17	- Modification completed to No. 1 burner throat and all primary air control dampers.	
Feb. 18	- Unit No. 1 in-service for a short time but it had to be shut down to repair a feed water valve.	
Feb. 19	- All day spent trying to optimize the settings of the large NRC guns to match the new fuel.	
Feb. 20 & 21	- Unit No. 1 shut down due a vacuum leak in the turbine condenser.	

	NRC Burner Test - CWF 4	OXCE Fuel Test - CWF 3
Feb. 23	- Further modifications to all the primary combustion air dampers, and No. 1 burner throat.	
Feb. 24	- The most suitable burner-gun settings established, to suit the new CWF, the viscosity of which was rappidly dropping.	
Feb. 25	- Three efficiency tests conducted of the Unit No.1 boiler, with the two large NRC in-service.	
	- All CWF at the Chatham Plant consumed.	
Mar. 4	- The first truck load of the second shipment of CWF arrived at the Chatham Plant.	
	- A larger primary air throat installed in the No. 1 burner.	
Mar. 4	- Unit No. 1 had to be shut down because of cooling water leak in the condenser.	
Mar 6 - 7	- Unit No. 1 in-service for over 28 hours.	
	- Burner No. 1 in-service burning CWF for 26 hours. Air atomization for 8 hours and steam atomization for 18 hours.	
	- All the CWF was consumed by 1:00 p.m. and the unit was shut down.	
	- This concluded the on-site testing, at the Chatham Plant, of the NRC burners under this demonstration contract.	

N.R.C. BURNER DEMONSTRATION

AT

NB POWER'S CHATHAM T.G. STATION

SECTION 16.3

COST SUMMARIES

PROGRESS CLAIM NO.	PERIOD COVERED
1	MARCH 85
2	APRIL 85
3	MAY 85
4	JUNE 85
5	JULY 85
6	AUGUST 85
7	SEPTEMBER 85
8	OCTOBER 85
9	NOVEMBER 85
10	DECEMBER 85
11	JANUARY 86
12	FEBRUARY 86
13	MARCH 86 (ESTIMATED)
14	MARCH 86 (ACTUAL)
15	APRIL 86

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

DATE : 05.AUGUST 1985
PROGRESS CLAIM : 01
PERIOD : MARCH 1985

FILE # 065Q.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	1,632.24	0.00	1,209.07	35%	423.17	1,632.24
2	Opacity Meter	0.00	0.00	0.00	0%	0.00	0.00
3	Consumable Material	1,151.15	0.00	1,001.00	15%	150.15	1,151.15
4	Travel & Living Allowance	61.88	0.00	53.81	15%	8.07	61.88
5	Direct charges	0.00	0.00	0.00	0%	0.00	0.00
6	Energy Credit	0.00	0.00	0.00	0%	0.00	0.00
	TOTAL:	2,845.27	0.00	2,263.88		581.39	2,845.27

PROGRESS CLAIM : (NET 30 DAYS) $2,845.27

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE :05.AUGUST 1985
PROGRESS CLAIM : 02
PERIOD : APRIL 1985

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

FILE # 06SQ.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	14,742.44	1,632.24	9,711.26	35%	3,398.94	13,110.20
2	Opacity Meter	0.00	0.00	0.00	0%	0.00	0.00
3	Consumable Material	3,415.42	1,151.15	1,968.93	15%	295.34	2,264.27
4	Travel & Living Allowance	614.17	61.88	480.25	15%	72.04	552.29
5	Direct charges	0.00	0.00	0.00	0%	0.00	0.00
6	Energy Credit	0.00	0.00	0.00	0%	0.00	0.00
	TOTAL:	18,772.03	2,845.27	12,160.44		3,766.32	15,926.76

PROGRESS CLAIM : (NET 30 DAYS) $15,926.76

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

DATE : 05.AUGUST 1985
PROGRESS CLAIM : 03
PERIOD : MAY 1985

FILE # 06SQ.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM BILLABLE COST	OVERHEAD & BURDEN %	OVERHEAD & BURDEN $	BILLABLE AMOUNT
1	Labour	32,696.72	14,742.44	13,299.47	35%	4,654.81	17,954.28
2	Opacity Meter	29,188.50	29,188.50	29,188.50	0%	0.00	29,188.50
3	Consumable Material	9,469.26	3,415.42	5,264.21	15%	789.63	6,053.84
4	Travel & Living Allowance	1,254.26	614.17	556.60	15%	83.49	640.09
5	Direct charges	0.00	0.00	0.00	0%	0.00	0.00
6	Energy Credit	0.00	0.00	0.00	0%	0.00	0.00
	TOTAL:	72,608.74	47,960.53	48,308.78		5,527.93	53,836.71

PROGRESS CLAIM : (NET 30 DAYS) $53,836.71

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
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515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

SCIENCE & PROFESSIONAL DIRECTORATE
DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE : 09 AUGUST 1985
PROGRESS CLAIM : 04
PERIOD : JUNE 1985

ATTN. Dr.R.G.AGARWAL

FILE # 065Q.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	OVERHEAD & BURDEN $	BILLABLE AMOUNT
1	Labour	57,855.21	32,696.72	18,635.92	35%	6,522.57	25,158.49
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	10,733.01	9,469.26	1,098.91	15%	164.84	1,263.75
4	Travel & Living Allowance	2,294.02	1,254.26	904.14	15%	135.62	1,039.76
5	Direct charges	13,036.66	0.00	13,036.66	0%	0.00	13,036.66
6	Energy Credit	0.00	0.00	0.00	0%	0.00	0.00
	TOTAL:	113,107.40	72,608.74	33,675.63		6,823.03	40,498.66

PROGRESS CLAIM : (TERMS : NET 30 DAYS) $40,498.66

C.C. Dr.HORACE WHALEY
CANMET.ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

SCIENCE & PROFESSIONAL DIRECTORATE
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11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE : 30 AUGUST 1985
PROGRESS CLAIM : 05
PERIOD : JULY 1985

ATTN. Dr.R.G.AGARWAL

FILE # 06SQ.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	87,063.39	57,855.21	21,635.69	35%	7,572.49	29,208.18
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	15,187.23	10,733.01	3,873.24	15%	580.98	4,454.22
4	Travel & Living Allowance	4,021.34	2,294.02	1,502.02	15%	225.30	1,727.32
5	Direct charges	37,790.33	13,036.66	24,753.67	0%	0.00	24,753.67
6	Energy Credit	(6,274.12)	0.00	(6,274.12)	0%	0.00	(6,274.12)
	TOTAL :	166,976.67	113,107.40	45,490.50		8,378.77	53,869.27

PROGRESS CLAIM : (TERMS : NET 30 DAYS) $53,869.27

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
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515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

SCIENCE & PROFESSIONAL DIRECTORATE
DEPARTMENT OF SUPPLY & SERVICES
1101 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

ATTN. Dr.R.G.AGARWAL

DATE :Sept. 30/85
PROGRESS CLAIM : 06
PERIOD : AUGUST 1985

FILE # 0650.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	119,748.98	87,063.39	24,211.55	35%	8,474.04	32,685.59
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	20,054.79	15,187.23	4,232.66	15%	634.90	4,867.56
4	Travel & Living Allowance	9,495.65	4,021.34	4,760.27	15%	714.04	5,474.31
5	Direct charges	71,993.33	37,790.33	34,203.00	0%	0.00	34,203.00
6	Energy Credit	(9,052.04)	(6,274.12)	(2,777.92)	0%	0.00	(2,777.92)
	TOTAL :	241,429.21	166,976.67	64,629.56		9,822.98	74,452.54

PROGRESS CLAIM : (TERMS : NET 30 DAYS) $74,452.54

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

SCIENCE & PROFESSIONAL DIRECTORATE
DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE :October 31,85
PROGRESS CLAIM :07
PERIOD :SEPTEMBER 85

ATTN. Dr.R.G.AGARWAL

FILE # 06SQ.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	120,894.90	119,748.98	848.83	35%	297.09	1,145.92
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	24,327.03	20,054.79	3,714.99	15%	557.25	4,272.24
4	Travel & Living Allowance	9,970.17	9,495.65	412.63	15%	61.89	474.52
5	Direct charges	75,215.00	71,993.33	3,221.67	0%	0.00	3,221.67
6	Energy Credit	(9,052.04)	(9,052.04)	0.00	0%	0.00	0.00
	TOTAL :	250,543.56	241,429.21	8,198.12		916.23	9,114.35

PROGRESS CLAIM : (TERMS : NET 30 DAYS) $9,114.35

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

SCIENCE & PROFESSIONAL DIRECTORATE
DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE :NOVEMBER 27,85
PROGRESS CLAIM : 08
PERIOD : OCTOBER 85

ATTN. Dr.R.G.AGARWAL

FILE # 0650.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	127,467.05	120,894.90	4,868.26	35%	1.703.89	6,572.15
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	29,200.82	24,327.03	4,238.08	15%	635.71	4,873.79
4	Travel & Living Allowance	10,379.40	9,970.17	355.85	15%	53.38	409.23
5	Direct charges	81,223.59	75,215.00	6,008.59	0%	0.00	6,008.59
6	Energy Credit	(9,052.04)	(9,052.04)	0.00	0%	0.00	0.00
	TOTAL :	268,407.32	250,543.56	15,470.78		2,392.98	17,863.76

PROGRESS CLAIM : (TERMS : NET 30 DAYS) $17,863.76

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

SCIENCE & PROFESSIONAL DIRECTORATE
DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE :December 18,85
PROGRESS CLAIM : 09
PERIOD :November 85

ATTN. Dr.R.G.AGARWAL

FILE # 06SQ.23440-4-9[illegible]
CONTRACT # 0SQ84 - 00420

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	159,445.74	127,467.05	23,687.92	35%	8,290.77	31,978.69
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	29,816.90	29,200.82	535.72	15%	80.36	616.08
4	Travel & Living Allowance	10,736.94	10,379.40	310.90	15%	46.64	357.54
5	Direct charges	130,055.15	81,223.59	48,831.56	0%	0.00	48,831.56
6	Energy Credit	(19,045.65)	(9,052.04)	(9,993.61)	0%	0.00	(9,993.61)
	TOTAL :	340,197.58	268,407.32	63,372.49		8,417.77	71,790.26

PROGRESS CLAIM : (TERMS : NET 30 DAYS) $71,790.26

C.C. Dr.HORACE WHALEY
CANMET.ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

DATE :FEBRUARY 12,1986
PROGRESS CLAIM : 10
PERIOD :DECEMBER 1985

FILE # 065Q.23440-4-9323
CONTRACT # 05Q84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	165,069.54	159,445.74	4,165.78	35%	1,458.02	5,623.80
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	30,882.75	29,816.90	926.83	15%	139.02	1,065.85
4	Travel & Living Allowance	11,032.65	10,736.94	257.14	15%	38.57	295.71
5	Direct charges	145,963.33	130,055.15	15,908.18	0%	0.00	15,908.18
6	Energy Credit	(19,045.65)	(19,045.65)	0.00	0%	0.00	0.00
	TOTAL:	363,091.12	340,197.58	21,257.93		1,635.61	22,893.54

PROGRESS CLAIM : (NET 30 DAYS) $22,893.54

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

DATE :FEBRUARY 28,1986
PROGRESS CLAIM :11
PERIOD :JANUARY 86

FILE # 06SQ.23440-4-9323
CONTRACT # 0SQ84 - 00420

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM BILLABLE COST	OVERHEAD & BURDEN %	OVERHEAD & BURDEN $	BILLABLE AMOUNT
1	Labour	164,100.94	165,069.54	(717.48)	35%	(251.12)	(968.60)
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	32,319.78	30,882.75	1,249.59	15%	187.44	1,437.03
4	Travel & Living Allowance	12,042.93	11,032.65	878.50	15%	131.78	1,010.28
5	Direct charges	149,230.90	145,963.33	3,267.57	0%	0.00	3,267.57
6	Energy Credit	(19,045.65)	(19,045.65)	0.00	0%	0.00	0.00
	TOTAL :	367,837.40	363,091.12	4,678.18		68.10	4,746.28

PROGRESS CLAIM : (NET 30 DAYS) $4,746.28

On file
Feb 26 86

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DP : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE :April 1/86
PROGRESS CLAIM :12
PERIOD :FEBRUARY 86

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

FILE # 06SQ.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	179,689.94	164,100.94	11,547.41	35%	4,041.59	15,589.00
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	32,504.93	32,319.78	161.00	15%	24.15	185.15
4	Travel & Living Allowance	12,430.09	12,042.93	336.66	15%	50.50	387.16
5	Direct charges	167,328.75	149,230.90	18,097.85	0%	0.00	18,097.85
6	Energy Credit	(19,045.65)	(19,045.65)	0.00	0%	0.00	0.00
	TOTAL:	402,096.56	367,837.40	30,142.92		4,116.24	34,259.16

PROGRESS CLAIM : (NET 30 DAYS) $34,259.16

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 KING STREET. P.O.BOX 2000. FREDERICTON: CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
1101 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET.
HULL: QUEBEC.
K1A 0S5

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

DATE :MAY 05 1986
PROGRESS CLAIM : 13
PERIOD :MARCH 86

FILE # 0650.23440-4-9323
CONTRACT # 05084 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCRIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	203,293.58	179,689.94	17,484.18	35%	6,119.46	23,603.64
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	38,784.54	32,504.93	5,460.53	15%	819.08	6,279.61
4	Travel & Living Allowance	14,317.83	12,430.09	1,641.51	15%	246.23	1,887.74
5	Direct charges	174,246.02	167,328.75	6,917.27	0%	0.00	6,917.27
6	Energy Credit	(26,292.47)	(19,045.65)	(7,246.82)	0%	0.00	(7,246.82)
	T O T A L :	433,538.00	402,096.56	24,256.67		7,184.77	31,441.44

PROGRESS CLAIM : (NET 30 DAYS) $31,441.44

OK John
May 5, 86

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE : MAY 16.1986
PROGRESS CLAIM : 14
PERIOD : MARCH 86 ACCURAL

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

FILE # 06SQ.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM BILLABLE COST	OVERHEAD & BURDEN %	OVERHEAD & BURDEN $	BILLABLE AMOUNT
1	Labour	203,293.58	203,293.58	0.00	35%	0.00	0.00
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	38,784.54	38,784.54	0.00	15%	0.00	0.00
4	Travel & Living Allowance	15,059.93	14,317.83	645.30	15%	96.80	742.10
5	Direct charges	225,606.67	174,246.02	51,360.65	0%	0.00	51,360.65
6	Energy Credit	(26,292.47)	(26,292.47)	0.00	0%	0.00	0.00
	TOTAL:	485,640.75	433,538.00	52,005.95		96.80	52,102.75

PROGRESS CLAIM : (NET 30 DAYS) $52,102.75

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 KING STREET, P.O.BOX 2000, FREDERICTON; CANADA N.B. E3B 4X1

DEPARTMENT OF SUPPLY & SERVICES
11C1 PLACE DU PORTAGE, PHASE III
11 LAURIER STREET,
HULL; QUEBEC.
K1A 0S5

DATE :MAY 28,1986
PROGRESS CLAIM :15
PERIOD :APRIL 86

ATTN. Dr.R.G.AGARWAL
SCIENCE & PROFESSIONAL DIRECTORATE

FILE # 065Q.23440-4-9323
CONTRACT # 0SQ84 - 00423

CANADA/NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM NRC COLD-WATER FUEL
DEMONSTRATION #4
JOB # 672-44000

PAYMENT ITEM #	DESCPIPTION	TOTAL TO DATE	PREVIOUS CLAIM	CURRENT CLAIM			
				BILLABLE COST	OVERHEAD & BURDEN %	$	BILLABLE AMOUNT
1	Labour	207,118.58	203,293.58	2,833.33	35%	991.67	3,825.00
2	Opacity Meter	29,188.50	29,188.50	0.00	0%	0.00	0.00
3	Consumable Material	33,959.81	38,784.54	(4,195.42)	15%	(629.31)	(4,824.73)
4	Travel & Living Allowance	14,710.73	15,059.93	(303.65)	15%	(45.55)	(349.20)
5	Direct charges	229,802.09	225,606.67	4,195.42	0%	0.00	4,195.42
6	Energy Credit	(26,292.47)	(26,292.47)	0.00	0%	0.00	0.00
	TOTAL:	488,487.24	485,640.75	2,529.68		316.81	2,846.49

PROGRESS CLAIM : (NET 30 DAYS) $2,846.49

C.C. Dr.HORACE WHALEY
CANMET,ENERGY RESEARCH LABORATORIES
DEPARTMENT OF ENERGY,MINES & RESOURCES

DR : 164-005-21100-27100
CR : 672-000-44000-27100

N.R.C. BURNER DEMONSTRATION

AT

NB POWER'S CHATHAM T.G. STATION

SECTION 16.4

MAJOR PURCHASE ORDERS

1.0 - 060 4012	OPACITY METER
2.0 - 060 6046	CIRCUIT RACK CASE FOR OPACITY METER
3.0 - 060 7033	LEASING OF RAIL TANK CARS FOR STORAGE
4.0 - 060 7290	COAL-WATER FUEL
5.0 - 060 7283	CWF ANALYSIS

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ENERGIE ELECTRIQUE DU NOUVEAU-BRUNSWICK

DATE
[illegible]5-03-29

SHIP TO DESTINATAIRE

071219

Canadian Applied Technology
1[illegible] Avenue
[illegible], Ont.
[illegible]3P 3[illegible]9

Chatham Generating Station
Lower Water Street
Chatham, NB

J. Young

F.O.B. POINT	DELIVERY - LIVRAISON	SHIP VIA	TERMS
Chatham, NB	SEE BELOW		Net 30 days

Chatham, NRC Test Burn No. 4
[illegible] 673-100[illegible] 4
[illegible] Measurement [illegible]

[illegible]

[illegible] density, filters, steel flanges, purge fan [illegible] weather shroud and US-EPA approval — D

b)	Single Blower	D	2,500.[illegible]
c)	Alignment Tool	D	735.[illegible]
d)	Data Cable (300 feet)	D	[illegible]
e)	Model 400A Linearizer/Integrator with single pen chart recorder	D	6,110.00
f)	Eight copies of Instruction Manual and three sets of Installation and Schematic Drawings	D	400.00
g)	Start up supervision, calibration and training	D	2,[illegible]

. . . . . /2

[illegible]0 2 33 1

672 000 44000 43100

C.R. [illegible] 4[illegible]
J.A. Shanks 2[illegible]

ORDER CONFIRMATION CONFIRMATION DE COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

527 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TÉLÉPHONE (506) 453-4444 TELEX 014-46194

SHIPPING ADDRESS TERMS AND CONDITIONS ARE AS NOTED ON PAGE ONE
L'ADRESSE D'EXPÉDITION ET LES MODALITÉS SONT MENTIONNÉES À LA PREMIÈRE PAGE

DATE: 85-03-29

ORDER CHANGE NO. / NO DE LA MODIFICATION DE COMM.:

PURCHASE ORDER NO. / NO DE COMMANDE: 060-4012

PAGE NUMBER / NO DE PAGE: 2 OF/DE 2

TO/À: Canadian Applied Technology

	DESCRIPTION			
h)	Shipping to Chatham, NB		D	290.00
	P.O. TOTAL			28,835.00

REFERENCE DOCUMENTS:

1) NBEPC Telex request for Tende February 27/85.

2) Canadian Applied Technology Telex Tender, February 28, 1985

SHIPPING INSTRUCTIONS:

Equipment:

N.B.E.P.C.
Chatham Plant
Water Street
Chatham, NB
ATTN: JOE YOUNG

B) NOTE: Manuals and Drawings:

N.B.E.P.C.
515 King Street
Fredericton, NB
E3B 4X1
ATTN: D.M. RANKIN

Shipments should reference customer Purchase Order Number above.

DELIVERY:

Week of April 8, 1985 to week of April 15, 1985. Please expedite to improve.

Confirmation of telephone order entered with June Christian 85-03-14.

1 VENDOR'S COPY COPIE DU

FORM NO. 9
REV. 23 10 74

NEW BRUNSWICK ELECTRIC POWER COMMISSION

PROJECT: Chatham, NRC Test Burn No. 4 DATE: 1985-05-29
MATERIAL LIST NUMBER: 672-1000-1A SHEET: 1 OF 1

Opacity Measurement System

REF. DWG.:
ACCT. DIST'N.: 672-000-44000 ORDER NO.: 060-4012
DRAWN: K. Brown CHECKED: APPROVED:

ITEM NO.	NO. REC'D.	DESCRIPTION	PRICE
		Please place a change order with -	
		Canadian Applied Technology	
		Buttonville, Ontario for the following:	
1(1)	1	Circuit Rack Case (400A of P Opacity System)	$150.00
		Taxes - extra	
		Delivery - via Purolator (cost to be invoiced to -	
		N.B. Power) with ETA	
		Chatham Plant on or before	
		June 10, 1985.	
		All the above as per telecom K. Brown and J. Christian	
		and attached telex K. Brown from J. Christian dated	
		May 29, 1985.	

M & S 832-042

CWF 4-4..

PURCHASE ORDER   COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TELEPHONE (506) 453-4444   TELEX 014-46194

SEE REVERSE SIDE FOR INVOICING AND SHIPPING INSTRUCTIONS
VOIR AU VERSO POUR LES INSTRUCTIONS RELATIVES À LA FACTURATION ET À L'EXPÉDITION

DATE: 85-06-14

PURCHASE ORDER NO. / Nº DE COMMANDE: 060-~~5046~~ 6046

VENDOR NUMBER: 071219

TO/À
Canadian Applied Technology
Buttonville Airport
Sixteenth Avenue
Markham, ON
L3P 3T9

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
Site
Chatham, NB

ATT K.C. Brown   FOR / POUR:

—Point of Origin	85-06-10		☐ INCLUDED / COMPRIS ☐ NOT INCLUDED / NON COMPRIS	Net 30 days

	Chatham, NRC Test Burn No. 4 Material List Number: 672-1001A Opacity Measurement System				
1(1)	Circuit Rack Case (400A of P Opacity System)			1	150.00
	Reference: Telcon, K. Brown and J. Christian, May 28, 1985 and telex to K. Brown from J. Christian dated May 29,1 985. Confirmation of telephone order entered by K.B. with J.C. May 30, 1985.				

[illegible]

ST	BYR	EXP	S-M	COM	AMOUNT
	010	3	33	1	

ITEMS	MAIN	SUB	COST CENTER	SOURCE CENTER	ASSET/COMP	TRACKING
	672	000	44000	44000		
H.O. USE	244	011	21120			

THIS ORDER IS SUBJECT TO ALL TERMS AND CONDITIONS SHOWN ON THE FACE AND REVERSE SIDE HEREOF AND IS NOT SUBJECT TO CHANGE OR MODIFICATION WITHOUT THE PRIOR WRITTEN CONSENT OF THE BUYER.

LA PRESENTE COMMANDE DOIT SE CONFORMER A TOUTES LES MODALITES INDIQUEES SUR CETTE PAGE ET AU VERSO ET NE DOIT PAS ETRE CHANGEE OU MODIFIEE SANS OBTENIR AUPARAVANT L'APPROBATION ECRITE DE L'ACHETEUR

AUTHORIZED / AUTORISEE
BUYER-ACHETEUR   DIR. OF PURCHASING-DIR. DES ACHATS

BUYER / ACHETEUR: C.F. Edgecombe 10 TELEPHONE 453-4242
EXPEDITER / ORDONNANCIER: K.F. Bell TELEPHONE 453-3169

1 VENDOR'S COPY - COPIE DU VENDEUR

FORM NO. 9
REV.23/10/74

NEW BRUNSWICK ELECTRIC POWER COMMISSION

PROJECT: Chatham, NRC Test Burn No. 4 DATE: 1985-05-29

MATERIAL LIST NUMBER: 672-1001A SHEET: 1 OF 1

Opacity Measurement System

REF. DWG.:

ACCT. DIST'N.: 672-000-44000 ORDER NO.: 060-6046

DRAWN: K. Brown CHECKED: APPROVED:

ITEM NO.	NO. REQ'D.	DESCRIPTION	PRICE
		Please place order with:	
		Canadian Applied Technology	
		Buttonville, Ontario for the following:	
1(1)	1	Circuit Rack Case (400A of P Opacity System)	$ 150.00
		Taxes - extra	
		Delivery - via Purolator (cost to be invoiced to	
		N.B. Power) with ETA	
		Chatham Plant on or before	
		June 10, 1985	
		All the above as per telecom K. Brown and J. Christian	
		and attached telex K. Brown from J. Christian dated	
		May 29, 1985.	

PURCHASE ORDER · COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TELEPHONE (506) 453-4444 TELEX 014-46194

SEE REVERSE SIDE FOR INVOICING AND SHIPPING INSTRUCTIONS
VOIR AU VERSO POUR LES INSTRUCTIONS RELATIVES A LA FACTURATION ET A L'EXPEDITION

DATE: 5-08-28

PURCHASE ORDER NO. / N° DE COMMANDE: 060-7033

VENDOR NUMBER: 069927

TO/A
C.G.T.X. Inc.
16 th Floor
1600 Dorchester Blvd. West
Montreal, Quebec
Att: Mr. J.V. Pasquini

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
Chatham Generating Station
Lower Water Street
Chatham, NB
ATT J. Young

F.O.B. POINT · POINT F.A.B.	DELIVERY · LIVRAISON	SHIP VIA · EXPÉDIER PAR	F.S.T. · T.F.V.	TERMS · ÉCHÉANCE
Chatham			☐ INCLUDED / COMPRIS ☒ NOT INCLUDED / NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW · TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	Monthly Progress 30 days

Chatham Units 1 and 2
Material list number: 790-1079A
Leasing of Rail Tanker Cars For The Coal/Water Burner Development

1	Lease of DOT 111A100W1 Rail Cars, Exterior Coiled and Insulated, Capacity 19,500 Imp. Gals CGTX No's 23104, 23126, 23171	3	F	675.00/car/mont

Reference: CGTX Inc. Agreement No. 02.01.2987 dated July 17, 1985 and their letter dated July 19, 1985.

Contract commencement date 85-07-15

Confirmation Only: Order entered by M. Thanisch 1985-07-15.

FEDERAL TAX CODES (IF NO LETTER APPEAR OPPOSITE AN ITEM THE CERTIFICATIONS ARE VOID AND FEDERAL SALES TAX IS APPLICABLE)
A WHEN INVOICING PLEASE SHOW AMOUNT OF F.S.T. INCLUDED IN THIS ITEM SEPARATELY
WE CERTIFY THAT THE GOODS ORDERED/IMPORTED HEREBY ARE TO BE USED
B AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT LICENSE NO. S 72218
C AS OUTLINED IN SECTION 2 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
D AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
E AS OUTLINED IN SECTION 4 OF PART VI OF SCHEDULE III OF THE EXCISE TAX ACT
F UNCONDITIONALLY EXEMPT
THE ABOVE FORMAT OF TAX CERTIFICATION APPROVED BY FEDERAL SALES TAX DEPARTMENT

CODES DE TAXE FÉDÉRALE (SI AUCUNE LETTRE N'EST INSCRITE VIS-A-VIS D'UN ARTICLE LES CERTIFICATIONS SONT ANNULÉES ET LA TAXE FÉDÉRALE SUR LES VENTES DOIT ÊTRE AJOUTÉE)
A VEUILLEZ INDIQUER SÉPARÉMENT SUR VOTRE FACTURE LE MONTANT DE LA T.F.V. COMPRIS DANS CET ARTICLE
NOUS CERTIFIONS QUE LES MARCHANDISES COMMANDÉES OU IMPORTÉES PAR LES PRÉSENTES SERVIRONT AUX FINS
B ÉNONCÉES AUX ARTICLES 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE PERMIS N° S 72218
C ÉNONCÉES A L'ARTICLE 2 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
D ÉNONCÉES AUX ARTICLE 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE DE LA LOI SUR LA TAXE D'ACCISE
E ÉNONCÉES A L'ARTICLE 4 DE LA PARTIE VI DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
F EXEMPTION SANS RÉSERVE
LE TEXTE DES CERTIFICATIONS DE TAXE UTILISÉ CI-DESSUS EST APPROUVÉ PAR LE SERVICE DE LA TAXE FÉDÉRALE SUR LES VENTES

ST	BYR	EXP	SM	COM	AMOUNT
	010	3	33	2	

	ACCOUNTING DISTRIBUTION			COST CONTROL		
	MAIN	SUB	COST CENTER	SOURCE CENTER	ASSET·COMP	TRACKING
	672	104	44000	44000		
HO USE ES AU BC	244	011	21120			

THIS ORDER IS SUBJECT TO ALL TERMS AND CONDITIONS [illegible] REVERSE SIDE HEREOF AND IS NOT SUBJECT TO CHANGE OR [illegible]

AUTHORIZED
AUTORISÉE
BUYER ACHETEUR · DIR. OF PURCHASING DIR. DES ACHATS

BUYER ACHETEUR CF Edgecombe 12 458-4242 TELEPHONE
EXPEDITER ORDONNANCIER K.F. Bell 458-3169 TELEPHONE

1 VENDOR'S COPY · COPIE DU VENDEUR

FORM NO. 9
REV.23/10/74

NEW BRUNSWICK ELECTRIC POWER COMMISSION

PROJECT: Chatham Units 1 and 2 DATE: July 31, 1985
MATERIAL LIST NUMBER: 790-1079A SHEET: 1 OF 1
Leasing of Rail Tanker Cars For The Coal/Water Burner Development

REF. DWG.:
ACCT. DIST'N.: 672 104 44000 ORDER NO.: 060-7033
DRAWN: P Carlisle CHECKED: M.R. Thanisch APPROVED:

ITEM NO.	NO. REQ'D.	DESCRIPTION	PRICE
		DO NOT RE-ORDER ------CONFIRMATION ONLY!	
		Place a Leasing Order with:	
		C.G.T.X. Inc.	
		Head Office, 16th Floor	
		1600 Dorchester Boulevard West	
		Montreal, Quebec	
		H3C 2R6	
		ATT: Mr. J. V. Pasquini	
		Sales Manager Eastern Region	
1	3	Type: DOT 111A100W1 Rail Cars, Exterior Coiled and	
		Insulated, Capacity 19,500 Imp. Gals	
		CGTX No.'s: 23104, 23126, 23171	
		These cars are to be leased for 2 to 3 months at a	
		service charge of $675.00 per car per month, as per	
		the CGTX inc. Agreement No. 02.01.2987 dated July 17/85	
		and their letter dated July 19/85.	

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 RUE KING STREET FREDERICTON N.B. CANADA E3B 4X1
TELEPHONE (506) 453-4444 TELEX 014-46194

SEE REVERSE SIDE FOR INVOICING AND SHIPPING INSTRUCTIONS
VOIR AU VERSO POUR LES INSTRUCTIONS RELATIVES À LA FACTURATION ET À L'EXPÉDITION

DATE: 86-04-09

PURCHASE ORDER NO. / NO DE COMMANDE: 060-7290

VENDOR NUMBER: 75322

TO / À

Cape Breton Development Corporation
PO Box 1330
Sydney, Nova Scotia
Attention: Mr. Adrian White

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 King Street
Fredericton, NB

ATT M.R. Thanisch FOR/POUR

F.O.B. POINT-POINT F.A.B.	DELIVERY-LIVRAISON	SHIP VIA-EXPÉDIER PAR	F.S.T.-T.F.V.	TERMS-ÉCHÉANCE
Destination	As required		☐ INCLUDED COMPRISE ☒ NOT INCLUDED NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	Net 30 Days

Coal water fuel for the NRC Burner Test and Baghouse Test as per ML 672-1003A.

F

CONFIRMATION ONLY

FEDERAL TAX CODES - IF A LETTER APPEARS OPPOSITE AN ITEM THE CERTIFICATIONS ARE VOID AND FEDERAL SALES TAX IS APPLICABLE.

A. WHEN INVOICING PLEASE SHOW AMOUNT OF F.S.T. INCLUDED IN THIS ITEM SEPARATELY

WE CERTIFY THAT THE GOODS ORDERED HEREBY ARE TO BE USED

B [illegible]
C [illegible]
D [illegible]
E [illegible]
F [illegible]

THE ABOVE FORMAT OF TAX CERTIFICATION APPROVED BY FEDERAL SALES TAX DEPARTMENT

CODES DE TAXE FÉDÉRALE [illegible]

ST	PYR				AMOUNT
	046	4	22	2	

ITEMS	MAIN	SUB	COST CENTER	SERVICE CENTER	ASSET COMP.	TRACKING
	572	208	44000	44000		
	244	011	21120			

THIS ORDER IS SUBJECT TO ALL TERMS AND CONDITIONS [illegible] REVERSE SIDE HEREOF AND IS NOT SUBJECT TO CHANGE OR MODIFICATION WITHOUT THE PRIOR WRITTEN CONSENT OF THE BUYER

LA PRÉSENTE COMMANDE DOIT SE CONFORMER À [illegible] AU VERSO ET NE [illegible] L'APPROBATION ÉCRITE DE L'ACHETEUR

AUTHORIZED AUTORISÉE ______ BUYER ACHETEUR

BUYER ACHETEUR Anne Brown 4 458-4-76
EXPEDITER ORDONNANCIER R. Miles 458-3432

1 VENDOR'S COPY - COPIE DU [illegible]

PURCHASE ORDER COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TELEPHONE (506) 453-4444 TELEX 014-46194

DATE: 86-04-09

PURCHASE ORDER NO / N° DE COMMANDE: 060-7283

SEE REVERSE SIDE FOR INVOICING AND SHIPPING INSTRUCTIONS
VOIR AU VERSO POUR LES INSTRUCTIONS RELATIVES À LA FACTURATION ET À L'EXPÉDITION

VENDOR NUMBER: 474490

TO/À
R.P.C.
PO Box 6000
Fredericton, NB
E3B 5H1

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
515 King Street
Fredericton, NB
E3B 4X1

ATT K. Brown FOR/POUR

F.O.B. POINT-POINT F.A.B.	DELIVERY-LIVRAISON	SHIP VIA-EXPÉDIER PAR	F.S.T.-T.F.V.	TERMS-ÉCHÉANCE
Destination	N/A		☐ INCLUDED COMPRISE ☒ NOT INCLUDED NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	Net 30 Days

	Analysis of CWF as per ML/672-1005				F	
	CONFIRMATION ONLY					

FEDERAL TAX CODES: (IF NO LETTER APPEARS OPPOSITE AN ITEM THE CERTIFICATIONS ARE VOID AND FEDERAL SALES TAX IS APPLICABLE)
A. WHEN INVOICING PLEASE SHOW AMOUNT OF F.S.T. INCLUDED IN THIS ITEM SEPARATELY
WE CERTIFY THAT THE GOODS ORDERED/IMPORTED HEREBY ARE TO BE USED
B. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT LICENSE NO. 0-72216
C. AS OUTLINED IN SECTION 2 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
D. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
E. AS OUTLINED IN SECTION 4 OF PART VI OF SCHEDULE III OF THE EXCISE TAX ACT
F. UNCONDITIONALLY EXEMPT
THE ABOVE FORMAT OF TAX CERTIFICATION APPROVED BY FEDERAL SALES TAX DEPARTMENT

CODES DE TAXE FÉDÉRALE: (SI AUCUNE LETTRE N'EST INSCRITE VIS-À-VIS D'UN ARTICLE LES CERTIFICATIONS SONT ANNULÉES ET LA TAXE FÉDÉRALE SUR LES VENTES DOIT ÊTRE AJOUTÉE)
A. VEUILLEZ INDIQUER SÉPARÉMENT SUR VOTRE FACTURE LE MONTANT DE LA T.F.V. COMPRIS DANS CET ARTICLE
NOUS CERTIFIONS QUE LES MARCHANDISES COMMANDÉES OU IMPORTÉES PAR LES PRÉSENTES SERVIRONT AUX FINS
B. ÉNONCÉES AUX ARTICLES 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE PERMIS N° 0-72216
C. ÉNONCÉES À L'ARTICLE 2 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
D. ÉNONCÉES AUX ARTICLE 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE DE LA LOI SUR LA TAXE D'ACCISE
E. ÉNONCÉES À L'ARTICLE 4 DE LA PARTIE VI DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
F. EXEMPTION SANS RÉSERVE
LE TEXTE DES CERTIFICATIONS DE TAXE UTILISÉ CI-DESSUS EST APPROUVÉ PAR LE SERVICE DE LA TAXE FÉDÉRALE SUR LES VENTES

ST	BYR	EXP	S-M	COM	AMOUNT	
	046	4	11	1		

TEMS	ACCOUNTING DISTRIBUTION			COST CONTROL		
	MAIN	SUB	COST CENTER	SOURCE CENTER	ASSET/COMP	TRACKING
	672	208	44000	44000		
H.O. USE RES AU B.C	244	011	21120			

THIS ORDER IS SUBJECT TO ALL TERMS AND CONDITIONS SHOWN ON THE FACE AND REVERSE SIDE HEREOF AND IS NOT SUBJECT TO CHANGE OR MODIFICATION WITHOUT THE PRIOR WRITTEN CONSENT OF THE BUYER

LA PRESENTE COMMANDE DOIT SE CONFORMER A TOUTES LES MODALITES INDIQUEES SUR CETTE PAGE ET AU VERSO ET NE DOIT PAS ETRE CHANGEE OU MODIFIEE SANS OBTENIR AUPARAVANT L'APPROBATION ECRITE DE L'ACHETEUR

AUTHORIZED AUTORISEE ____________________
BUYER-ACHETEUR DIR OF PURCHASING-DIR DES ACHATS

BUYER ACHETEUR Anne M. Brown 4 TELEPHONE 458-4478
EXPEDITER ORDONNANCIER R. Miles TELEPHONE 458-3432

1 VENDOR'S COPY - COPIE DU VENDEUR

N.B. POWER
FORM 263 1085-01
M & S 832-040

PURCHASE REQUISITION
(REGULAR)

REQUISITION NUMBER	
location	serial
060	7283

PURPOSE OR USE: URC Demonstration - Baghouse Test

WHEN RECEIVED ADVISE:

	STREET AND NO.	CITY OR TOWN	ATTENTION
DELIVER TO:	515 King St.	Fredericton, NB E3B 4X1	K. Brown

ITEM	ITEM DESCRIPTION	STOCK CODE NO.	QUANTITY	PRICE
	Analysis of CWF as per			
	ML/ 672-1005			
	Confirmation Only.			

ITEMS	ACCOUNTING DISTRIB'N.			COST CONTROL			AMOUNT	SUPPLIER AND ADDRESS
	Main	Sub	Cost Centre	Source Centre	Asset/Comp	Tracking		R.P.C
	672	208	44000	44000				

VENDOR NUMBER:

STATUS:

PURCHASING DEPARTMENT USE ONLY

PROVINCIAL SALES TAX		Items	FEDERAL SALES TAX		Items			Items
0	EXEMPT		A	R.O.A.		E	FUEL OIL	
8	EXTRA		B	III & LIC.		F	N/A	
1	INCLUDED		C	III & SEC. 2		G	TAXABLE 10%	
	AMOUNT SUBJECT	$	D	III SEC.1,3,4		H	TAXABLE 06%	
						I	INCLUDED	

BUYER CODE

EXPEDITER CODE

SUPP. & MAN. CODE

COMMODITY CODE

TERMS AND CONDITIONS OF SALE

F.O.B.	DELIVERY VIA	F.S.T.	TERMS OF PAYMENT
		☐ INCLUDED ☐ NOT INCLUDED	

REQUESTED BY	DATE	APPROVED-BR.PLANT OR DEPT.HEAD	DATE	APPROVED-DIVISION MANAGER	DATE
1 J. Thibodeau	860325	2		3	
CLEARED-GENERAL STORES	**DATE**	**PURCHASE ORDER AUTHROIZED**	**DATE**	**FINALIZED-PURCHASING**	**DATE**
4		5		6	

FORM NO. 9
REV. 23/10/74

NEW BRUNSWICK ELECTRIC POWER COMMISSION

PROJECT: NRC DEMONSTRATION-BAGHOUSE TEST DATE: 1986 03 24

MATERIAL LIST NUMBER: 672-1005 SHEET: ____ OF ____

REF. DWG.:

ACCT. DIST'N.: 672-208-44000 ORDER NO.: 060-7283

DRAWN: K. Brown CHECKED: ____ APPROVED: ____

ITEM NO.	NO. REQ'D.	DESCRIPTION	PRICE
		Please place a confirmation order with RPC for the	
		analysis of CWF as per the direction of M. R. Thanisch	
		to RPC's Derek Kirby.	
		Approximate cost $140.00. Report on findings to be	
		available in week of March 24/86.	

N.B. POWER
FORM 283 1985-04
M & S 600-040

PURCHASE REQUISITION
(REGULAR)

REQUISITION NUMBER	
Location	Serial
1000	[illegible]

PURPOSE OR USE: Chatham Unit No. 1

WHEN RECEIVED ADVISE:

DELIVER TO:
STREET AND NO.: 515 King Street
CITY OR TOWN: Fredericton
ATTENTION: Mr. R. [illegible]

ITEM	ITEM DESCRIPTION	STOCK CODE NO.	QUANTITY	PRICE
	Coal water fuel for the NRC		EST.	40,000.00
	Burner Test and Baghouse Test			
	as per ML 672-1003A			
	Confirmation Only			
	- Order Already Placed -			

ITEMS	ACCOUNTING DISTRIB'N. Main	Sub	Cost Centre	COST CONTROL Source Centre	Asset/Comp	Tracking	AMOUNT
	672	208	4400	[illegible]	—	—	

SUPPLIER AND ADDRESS
Cape Breton Development
Corporation
P.O. Box 1330
Sydney Nova Scotia
Attn: Mr. [illegible]

VENDOR NUMBER:
STATUS:

PURCHASING DEPARTMENT USE ONLY

PROVINCIAL SALES TAX	Items	FEDERAL SALES TAX	Items		Items	
D EXEMPT		A R.O.A.		E FUEL OIL		BUYER CODE
E EXTRA		B 1111 & LIC.		F N/A		EXPEDITER CODE
I INCLUDED		C 1111 & SEC. 2		G TAXABLE 10%		SUPP. & MAN. CODE
AMOUNT SUBJECT	$	D 1111 SEC.1.3.4		H TAXABLE 06%		COMMODITY CODE
				I INCLUDED		

TERMS AND CONDITIONS OF SALE

F.O.B.
DELIVERY
VIA
F.S.T. ☐ INCLUDED ☐ NOT INCLUDED
TERMS OF PAYMENT

REQUESTED BY	DATE	APPROVED-BR.PLANT OR DEPT.HEAD	DATE	APPROVED-DIVISION MANAGER	DATE
1 [illegible]	[illegible]	2		3	
CLEARED-GENERAL STORES	DATE	PURCHASE ORDER AUTHORIZED	DATE	FINALIZED-PURCHASING	DATE
4		5		6	

FORM NO. 9
REV.23/10/74

NEW BRUNSWICK ELECTRIC POWER COMMISSION

PROJECT: Chatham Unit No.1 DATE: 1986-02-07

MATERIAL LIST NUMBER: 672-1003 A SHEET: 1 OF 2

Coal Water Fuel for the NRC Burner Test and Baghouse Test

REF. DWG.:

ACCT. DIST'N.: 672-208-44000 ORDER NO.: 060-7602

DRAWN: M.R.Thanisch CHECKED: APPROVED:

ITEM NO.	NO. REQ'D.	DESCRIPTION	PRICE
		CONFIRMATION of an order already placed.	
		Please place an order with:	
		Cape Breton Development Corporation	
		P.O. Box 1330	
		Sydney, NOVA SCOTIA	
		Attention: Mr.Adrian White	
		Director of Process Technology	
		for the supply and delivery of:	
1		Approximately 190 tonnes of Carbogel Coal-Water Fuel (CWF). The delivery is to be broken down into two parts.	
2		3 Truck Loads (approximately 96 tonnes). The first truck load is to arrive at the Chatham Generating Station on Friday - February 14, 1986 with the remaining two truck loads the following week.	
3		The remainder of the fuel is ONLY to be shipped after it has been requested by N.B.Power's Chatham Plant Manager.	

FORM NO. 9
REV.23/10/74 **NEW BRUNSWICK ELECTRIC POWER COMMISSION**

PROJECT: Chatham Unit No.1 DATE: 1986-02-07

MATERIAL LIST NUMBER: 672-1003 A SHEET: 2 OF 2

REF. DWG.:

ACCT. DIST'N.: ORDER NO.: 060-7602

DRAWN: M.R. Thanisch CHECKED: APPROVED:

ITEM NO.	NO. REQ'D.	DESCRIPTION	PRICE
4		For a cost per tonne of:	
		Coal Water Fuel $ 165.00 per tonne	
		Freight to Chatham 51.00 per tonne	
		TOTAL $ 216.00 per tonne	
5		Estimate Total Value of this Order	
		$ 40,000.00 (Canadian)	
6		All as per the following correspondence:	
		N.B.Power's 13 December 85	
		18 December 85	
		22 January 86	
		7 February 86	
		C.B.D.C.'s 17 December 85	
		20 December 85	
		24 January 86	

N.R.C. BURNER DEMONSTRATION
AT
NB POWER'S CHATHAM T.G. STATION

16.5 PROJECT REPORTS

REPORT NO.	SUBJECT	DATE OF REPORTS
1	Report on the First NRC Burner Test 13 and 14 May/85.	15 May 1985
2	Report on the No. 1 Burner Modifications 7 & 8 June/85.	10 June 1985
3	Report on the NRC Burner Test 18 & 19 June/85.	19 June 1985
4	Reports on the Test of the new EMR Modifications to the No. 1 Burner.	3 July 1985
5	Report on Site Visit.	4 July 1985
6	Report on-Site Visit and Summary of week's Testing of EMR/NRC Burner Modifications.	5 July 1985
7	Meeting covering Site and Testing to date.	8 July 1985
8	Meeting to overcome Environmental problems while burning C.W.F.	17 July 1985
9	Follow-up to Meeting of July 17/85.	31 July 1985
10	Site Visit on September 24/85.	24 Sept 1985
11	Report on Boiler Leak, Nov. 12-15/85.	18 Nov 1985
12	Site Visit November 19 & 20/85.	21 Nov 1985
13	Report on Burn Test Nov. 18-26/85.	29 Nov 1985
14	Test Burn the week of Feb. 18 to 21/86.	24 Feb 1986
15	Test Burn the week of Feb. 24 to 26/86.	27 Feb 1986
16	Test Burn the week of March 5 to 8/86.	10 Mar 1986
17	Site Report from Plant Manager covering the Burn for March 6 and 7/86.	10 Mar 1986
18	Review of Test Burn.	12 Mar 1986

File: CWF-4 Chatham
Coal/Water Burner Development
NRC BURNER TEST- REPORT
Date: 15 MAY 86

MAY 13/85

The test was to have commenced at 8:00 AM on Unit No. 1 boiler.

Representatives from NRC arrived at 8:00 AM but their equipment did not arrive until mid morning.

The NRC group consisted of the following people:

W. Thayer - leader of the group
Adrian Bennett
Kevin Jonasson
N. Phelp

Mr. David Lawrence arrived by mid morning from CLM Technologies Limited to aid and observe the test.

N.B. Power was represented by the following:

Don MacDonald
Keith Keoughan
Raymond McCarthy
Burt Cooper
Ken Brown

The initial work involved the opening of the hatch in the boiler hopper to allow people access and the placement of a video camera at another hatch in the boiler hopper so that a record of the spray pattern from the nozzle could be observed.

The No. 4 burner swiller was removed and in removing the swiller the tube was damaged and a stainless steel extension piece had to be added to make up for the portion that was damaged.

The NRC gun to be tested has the capability of being adjusted in and out relative to the burner sleeve by an outside adjusting ring. The gun also is jacketed to allow for steam heating of the fuel as it passes through the gun barrel. A thermocouple has also been fitted to the gun tip.

Keith, Raymond and myself reviewed the test procedures used on the previous demonstration burns as well as the record of test data available in Keith's logs. This data has served well on previous burner tests and our review helped Raymond understand the purpose for having such data. Raymond was recently transferred from the Grand Lake Plant in preparation for his assignment to the commissioning team on Chatham No. 3. His role on this test is to provide a liason between the test group/N.B. Power - head office with the operations staff at the Chatham plant. His interest in this test work should be a definite asset for this demonstration.

The coal bunker that was converted to store coal water fuel is now full. It appears that CBDC has sent us 200 metric tons instead of 200 short tons of Carbogel. This might produce a problem for us relative to the OXCE burn.

According to the plant chemist, it has been difficult to sample the carbogel in the rail car and hopper in that the collector device that is used leaks. Therefore, the sample taken is not totally representative of a particular level in the rail car or hopper. Data of samples taken on this recent shipment are available and it does appear that there is some degree of settling out.

This settling out is not a concern to the Plant people as it is felt that with the capability to recirculate the stored carbogel, bubble compressed air through the carbogel plus the effect of the two paddle mixers in the hopper there should be no problem producing a homogenous mixture for the actual burn demonstration.

MAY 14/85

Two additional people arrived this morning --

Kelly Thambimuthu - CANMET
David Barnett - MMB

A meeting was held at the start of the day with all parties present to review the burner configuration and the relative adjustments identified as optimum on previous tests.

Basic criteria that was agreed to for purposes of this test were as follows:

- 14½" distance between the face of the refractory and main burner guide tube
- 5½" distance between the inside camfer of the refractory and the main burner guide tube
- 80° spray angle from the burner tip
- that a water spray test would be conducted with the conventional swirl plate, without a swirl plate and with the swirl plate provided by NRC varying primary and secondary air through all combinations

Keith Koughan had to excuse himself from the test after this meeting in order to attend a meeting in Nova Scotia.

The test had a setback at this point in that the burner sleeve was binding restricting the insertion into the burner. The stainless steel piece that was added yesterday to the sleeve had some angular distortion that caused binding and had to be corrected by turning the sleeve down on a lathe in the plant machine shop. This work coincided with the preparation of plumbing connections to the water and air systems on the special manifold. The water test therefore did not begin until after the lunch hour.

Will Thayer requested the hookup of carbogel line to his manifold but this was rejected by Don MacDonald on the basis of it being not absolutely necessary. This operation would require that all of the lines be purged of the carbogel and dumped to the ash pit. At this time the plant staff are dealing with oil that has been dumped by construction into their ash lagoon. It was agreed that this calibration could be done just prior to the resumption of testing in June.

The water test was carried out with the F.D. & I.D. fans on. (furnace air pressure @ 2.0" WG and quantity of air at 75,000 lbs/hr) All spray patterns are captured and identified on video tape.

Some basic observations were:

1) The slots cut in the original swirllers are overl large and interfer with a uniform spray pattern.

2) The swiller supplied by NRC is better but does not have provision for igniter discharge.

3) The test manifold does not provide a great restriction to people access around the burner front.

4) It will be sufficient to provide cut ins complete with a check valve and isolating valve only on the manifolds near burned No. 4. One supply is required from the air, steam, bunker "C" and light F.O. manifolds. On the steam line it will be necessary to provide a second branch to be reduced in fitting size suitable for connection to the steam jacket on the gun.

5) Connections from the test manifold to the burner gun No. 4 will be via flexhose. Tests to be conducted on other burners will be via connection to the existing burner manifold plumbing.

6) The water test has provided some optimism that primary air can be used which should result in the removal of the dark center prevalent in previous burns.

This evening the plant people will be installing a simple platform in the area of the burners to facilitate making adjustments and changes to the burners from inside the boiler. They will also install a connection from the light oil manifold to the test manifold so a light oil burn demonstration can be conducted tomorrow. The NRC swiller will be provided with guide tubes that will allow light oil igniter discharge. This modification will preserve the uniform spray pattern achieved in the water test. This work is also being done by the plant staff this evening.

Willy Thayer has reviewed his current schedule and believes he will be back to complete the test on June 17, 1985. At that time he feels that the following responsibilities should be clearly identified:

Fuel monitoring/testing - N.B. Power
Flue gas analysis - N.B. Power
Boiler efficiency tests - N.B. Power
Air quality monitoring - N.B. Power
Flame monitoring - CANMET
Video of flame - NRC
Direction of flame tests - NRC

It was agreed that I would ensure that N.B. Power would have the necessary efficiency and air quality monitoring people available for the test, Don MacDonald would ensure availability of adequate plant staff and that confirmation of the June 17, 1985 date would be through Kelly Thambimuthu.

The test crew were able to clean up at 4:10 PM allowing the plant people to proceed on the work necessary to be completed for tomorrow's 9:00 AM demonstration burn firing light oil.

MAY 15/85

In an early morning meeting with Donald MacDonald I asked if the light oil tanks could be guaged for oil use on this upcoming test. He related to me that because of their auxiliary heating requirement, the estimation of use is the best system they have. Oil meters were to be calibrated and installed in the lines but this hadn't happened. For this test today he had no problem with absorbing the cost in that N.B. Power had to heat the boiler anyway to aid the effect of the chemicals placed in the boiler for cleaning.

It is expected that no steam would be generated thus no energy credit for todays test.

The NRC and CANMET representative had reviewed the tapes of yesterdays water test and wanted to remove the register off No. 3 burner, insert the small gun and fire light oil without the register.

Prior to starting the oil test NRC wanted to run another water test on No. 4 burner with the large gun, varying the blade position of the secondary air dampers. The purpose for this test is to establish whether or not a higher tangential velocity can be created to strengthen the control the atomized fuel.

Kelly Thambimuthu would like to remove the inboard part of the burner housing, add a spacer ring and perform another water test prior to the June burn. The object of this exercise is to establish a better wind box design which he feels would be the next logical step in improving better flame control. He suggested that the refractory should be reprofiled around the burner. Presently refractory has worn away and indeed appears to have been roughly shaped in the first place. I am to send him manufacturers drawings which will indicate how it should have been installed. In his view, he should be able to perform some calculations, draw up the modification by the first week in June.

Mr. Thambimuthu will approach Mr. Whaley for funds to support a throat modification. The basic view is that by reshaping the throat, recirculation will occur causing particles of fuel to move to the centre of the flame. This gain will more than offset the heat support to combustion from the present arrangement.

If this effort can be funded, word will be received during the last week in May with actual modification to be done the week prior to the second phase of the demonstration.

Coordination and confirmation of the schedule for resuming the demonstration will be through Mr. Thambimuthu's office.

Burt Cooper has been advised as to the location and work that his staff is to carry out before the next phase of this demonstration.

This work includes the following:

- installation of ties for steam, air, cwf, light oil and bunker C from the burner front manifolds adjacent to No. 4 burner.
- installation of opacity meter at a point identified by myself on the breeching for Unit No. 1.
- provision of a layout table, set of wrenches etc. for second pahse of the test.
- replacement of swirlers for burners 1, 2 & 3 similar to the new one currently installed on burner No. 4.
- make up of a spacer for the throat on No. 3 burner if funds are obtained for Mr. Thambimuthu's idea.

The basic conclusions of the first phase of this demonstration are:

- the nozzle and gun performed very well.
- there is a consensus that the secret to further improvement will relate to air control.
- the light oil is so volatile that the influence of varying secondary air had no dramatic effect. It is expected that secondary air will have noticeable effect on bunker C and carbogel. Mr. Thambimuthu feels that it is necessary to modify the refractory at the burner throat.

During the next phase of the test, four guns will be tested. All of the camera equipment has been left along with the test manifold in the care of Chatham Plant staff.

It is expected that the boiler will be fired at approximately half load over a period of a week at which time a base setting of the dampers will be established firing bunker C after all firing will be on carbogel alone.

Tentatively the second phase of the burn will be the week of June 17/85. Don MacDonald pointed out that June 20/85 is the official opening of the Chatham Unit 3 and that our testing of coal water fuel will be a welcomed activity.

The first phase of testing concluded at 4:55 PM, May 15, 1985.

NRC Tests #1 Boiler - May 14 & 15, 1985

	1	2	3	4	5	6	7	8	9
Date	85-05-14	85-05-14	85-05-14	85-05-15	85-05-15	85-05-15	85-05-15	85-05-15	85-05-15
Time	13:35	14:20	15:05	13:40	14:00	14:30	14:55	15:30	15:40
Burner	#4	#4	#4	#4	#3	#4	#4	#3	#3
Swirler	old	none	modified	modified	none	modified	modified	none	none
Total Air Flow	75,000lb/hr	85,000lb/hr	82,000lb/hr	55,000lb/hr	55,000lb/hr	65,000lb/hr	77,000lb/hr	70,000lb/hr	70,000lb/hr
F.D. Fan Discharge	5.0	6.3	6.5	3.0	3.8	4.2	4.2	4.4	4.5
Sec. Air Press. & A.H. Out	1.4	2.0	2.0	1.5	2.3	2.4	2.3	2.5	2.6
Wind box	2.0	2.0	2.0	2.0	2.2	2.2	2.2	2.3	2.5
Furnace Draft	-.07	-.07	-.08	-.1	-.12	-.06	-.18	-.1	-.11
Boiler Uptake	-0.6	-0.7	-0.7	0.4	0.45	0.55	0.8	0.55	0.6
Dust Collector Out Draft	2.1	2.5	2.4	1.2	1.3	1.6	2.2	1.6	1.75
A.H. Out Draft	4.7	5.3	5.2	2.8	2.8	3.8	4.7	3.6	3.8
Secondary Air Damper	open	30% open	varied	varied	varied	50%	varied	100% open	70% open
Secondary Air Vanes	30-40°	30-40°	30-40°	20°	30-45°	20°	20°	30-45°	30-45°
Primary Air Damper	closed	open	varied	varied	varied	50%	varied	10% open	20% open
F.D. Amps	100	105	103	93	93	93	93	93	93
ID Amps	115	125	120	98	98	110	110	103	103
Atomizing Pressure	-	-	-	-	-	air 38	air 33	air 32	air 50
Fuel Pressure	water 27 psi	water 28 psi	water .47	water 42	water 32	#2 oil 35	#2 oil 28	#2 oil 16	#2 oil 38
Atomizing Air Flow	-	-	-	-	-	40 SCFM	40 SCFM	-	-
Gun Temperature	-	-	-	-	-	-	-	-	-

REMARKS: Test #4 - using NRC 10 U.S. G.P.M. Gun
Test #5 - using NRC 2 U.S. G.P.M. Gun
Test #6&7 - using NRC 10 U.S. G.P.M. Gun

Test #7&8 - using NRC 2 U.S. G.P.M. Gun

Adjustments made to gun position, spray nozzle, fuel pressure, atomizing air pressure, and air dampers to change flame patterns

File: CWF 4 Chatham
Coal/Water Burner
Development
NRC Burner Test

June 10, 1985

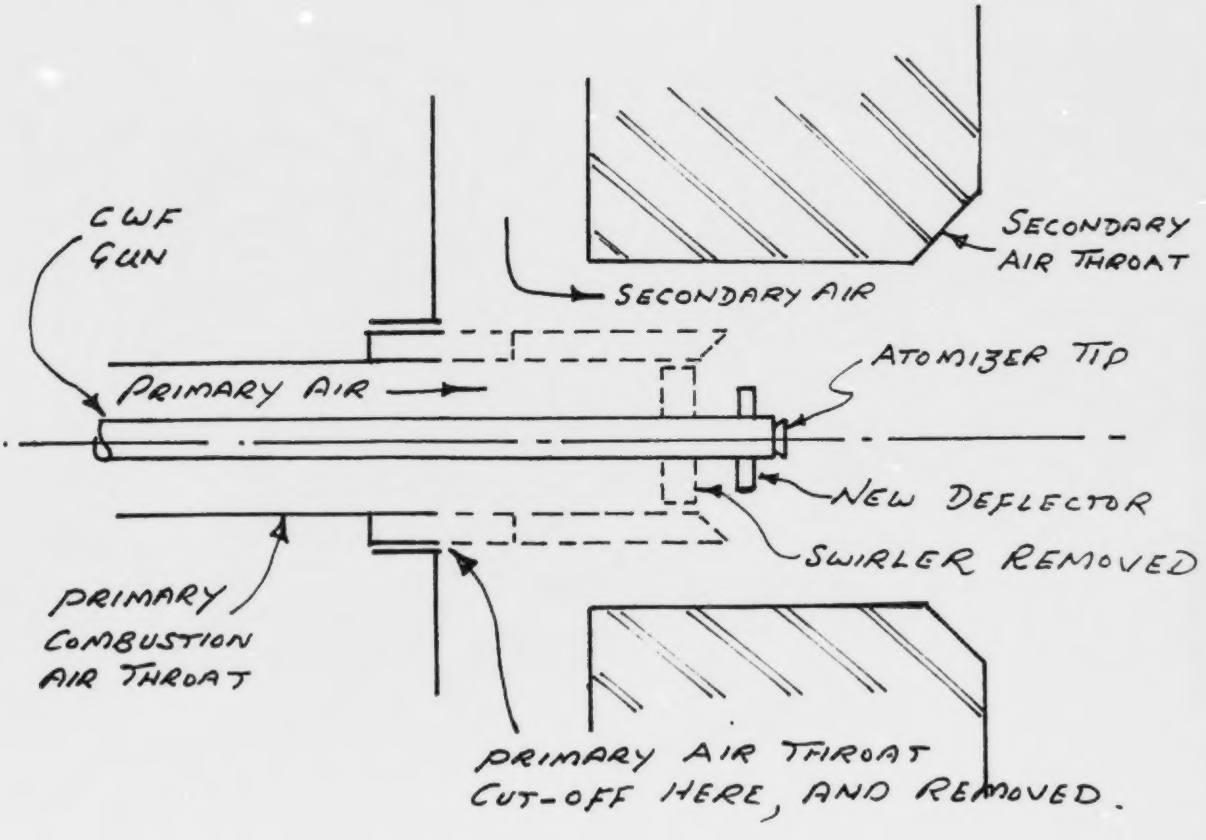
REPORT ON VISIT TO THE CHATHAM T.G. STATION

DATE: June 7 and 8, 1985

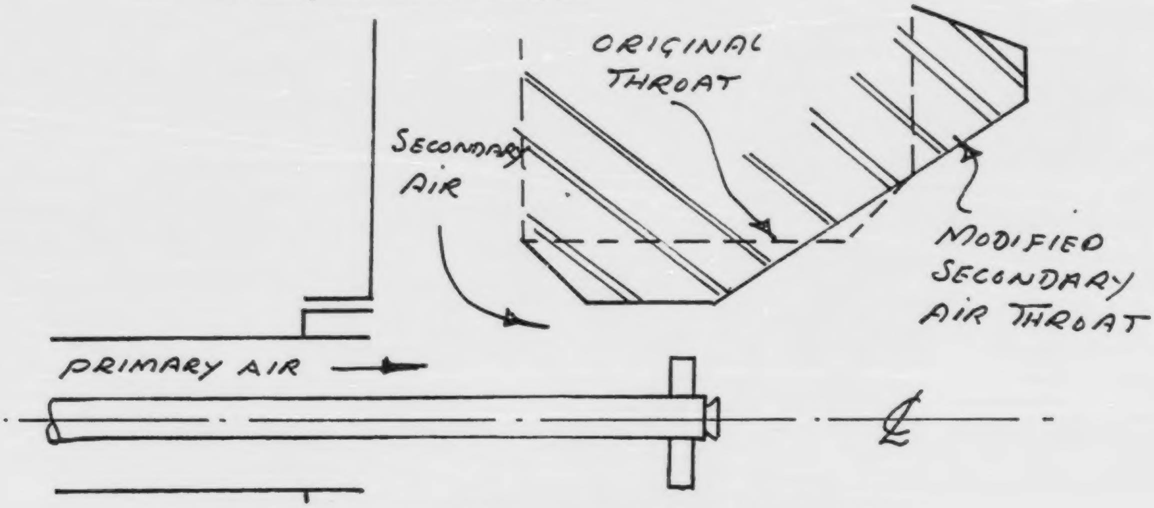
REASON: To oversee the "EMR" modifications to the No. 1 burner throat in the No. 1 boiler, to try and improve the control and shape of the C.W.F. flame.

DETAILS: I arrived at the Chatham Plant at 8:45 am. Dr. Kelly Thambimutha of EMR in Ottawa and Dave Lawrence of MBB in Halifax arrived on site at 9:30 am.

Most of the day was spent having the primary combustion air throat cut back. This was done so that the secondary air could mix with the primary air before reaching the atomizer tip.


CWF GUN
SECONDARY AIR
SECONDARY AIR THROAT
PRIMARY AIR
ATOMIZER TIP
NEW DEFLECTOR
SWIRLER REMOVED
PRIMARY COMBUSTION AIR THROAT
PRIMARY AIR THROAT CUT-OFF HERE, AND REMOVED.

- On Saturday, June 8, 1985, Kelly and Dave conducted water spray tests to find out if the new fuel/air flow of the modified burner had been improved.
- On Monday, June 10, 1985, Kelly reported the water spray test had gone sufficiently well to warrant further modification to the secondary air burner throat.


ORIGINAL THROAT
SECONDARY AIR
MODIFIED SECONDARY AIR THROAT
PRIMARY AIR
℄

- Dave Lawrence reported his company, MBB would be able to complete the secondary air throat modifications by June 14, 1985.

Prepared by

M. R. Thanisch

M.R. Thanisch
Project Engineering Coordinator

cc: D.M. Rankin - Project Manager
Don MacDonald - Plant Manager

File: CWF 4 Chatham
Coal/Water Burner
Development
Burner Throat Testing

June 19, 1985

REPORT ON VISIT TO THE CHATHAM T.G. STATION

DATE: June 18, 1985

REASON: To witness testing of the NRC gun in the original burner throat (No. 4) and the modified No. 1 burner throat.

DETAILS: I arrived at the Chatham Plant at 8:50 am.

- There were people from both NRC and EMR on site to test both the NRC gun and EMR burner throat modifications.
- For some unknown reason the steam pressure was pulsating at the No. 4 burner, and a stable flame could not be obtained so the new NRC burner was switched to the modified No. 1 burner. In this location the NRC gun worked well.
- On June 19, 1985 Unit No. 1 was in service burning coal-water fuel.
- There are some problems with the opacity meter. It is felt the reading is not correct because of some problems the supplier's technician had with the equipment when he was commissioning it, after it had been installed.
- The air compressor supplied from the Lepreau site is not performing well.

Prepared by

M.R. Thanisch
Project Engineering Coordinator

cc: D.M. Rankin - Project Manager

File: CWF 4 Chatham
Coal/Water Burner Development
NRC TEST. MEETING
Date: 3 July 85

REPORT ON VISIT TO
THE CHATHAM THERMAL GENERATING STATION

DATE: 3 July 1985

REASON: To witness the NRC/EMR, Coal Water Fuel Burner Test Program in the Chatham No. 1 Boiler.

DETAILS: I arrived in the plant at 9:00 a.m. and held two meetings.

One with the EMR/NRC people to plan their test program.

People Present	-	Don MacDonald	NB Power
	-	Jack Flanagan	NB Power
	-	Mike Thanisch	NB Power
	-	Dr. Willy Thayer	NRC
	-	Dr. Adam Bennett	NRC
	-	Dr. Kelly Thambimuthu	EMR

It was agreed the top priority would be given to testing the NRC atomizer in the No. 1 burner with the modified throat. Once this burner/atomizer has been optimized the second NRC atomizer will also be put in service in the No. 4 burner with the modified swirler so the performance of both arrangements can be compared.

While doing this testing it was agreed as much CWF as possible would be burnt in the other two burners with the Forney atomizer.

Second Meeting

Don MacDonald and I had a meeting with Bob Kazmel, the Manager of CBDC's Fuel Preparation Plant, who was in Chatham to view the NRC/EMR test burn. The meeting was regarding what to do with the three additional rail cars of coal water fuel (CWF) now on the CN Rail siding in Newcastle.

Mr. Kazmel was told it was most unlikely the Chatham plant could have burnt three rail cars of CWF in addition to the bunker full of fuel they already had before C.E. Canada/KDL came to the site on July 15, 1985 to start the OXCE Fuel Test program. In addition, he was told if CBDC wish to have their rail cars back by Mid-July they would have to be sent back full of fuel.

Mr. Kazmel said they could not accept the fuel back because they had not additional storage capacity and they would be very reluctant to dump good fuel, even if they had somewhere to dump it.

Messrs. MacDonald and Thanisch said they did not know if it would be possible to burn out the present bunker of fuel before this week's test program was completed. It was felt that, with two large NRC (20 x 10^6 BTU) burners and two Forney burners(40 X 10^6 BTU,), about 4 to 5 tons of CWF could be burnt an hour for a max. of 8 hours a day. This would take at least six days to burn out the bunker.

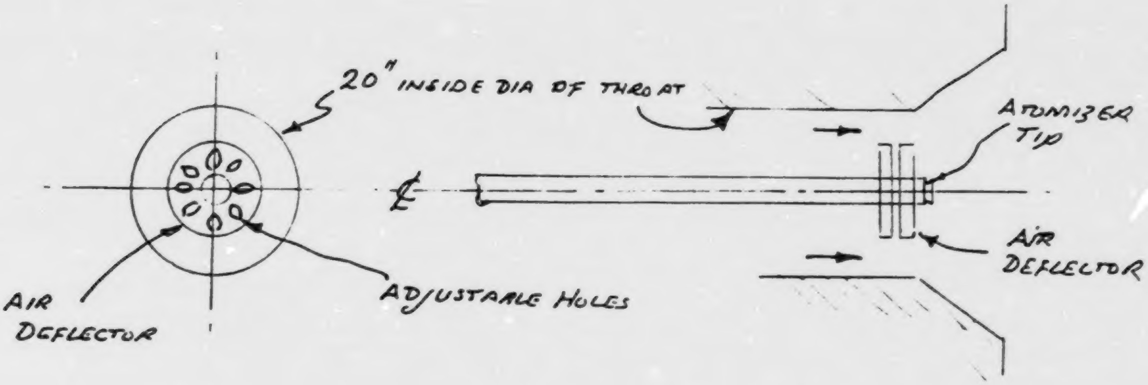
Report on the Day's Test Burn

9:00 AM	The unit was heated up with the ignitor guns, and one heavy oil gun.
11:30 AM	The operators tried to put a Forney CWF gun in-service, No. 2 Burner, but the CWF supply line was plugged.
11:45 AM	They tried a Forney CWF gun in No. 4 Burner but the CWF supply was also plugged.
12:00 NOON	A fitter remove the bonnet from the check valve on the No. 2 Burner and flushed the line and valve out; this was repeated for Burner No. 3 and No. 4. (This can only be done when the CWF pump is out of service.
	No. 1 Burner was in-service with a heavy oil gun heating up both the burner throat and boiler.
12:45 PM	No. 4 Burner was tried with the Forney gun and CWF but it had to be removed because the opacity reading went to 65%.
1:15 PM	No. 2 Burner in-service with the Forney gun and heavy oil.
2:40 PM	No. 1 gun switched from heavy oil to CWF and, once the ignitor was removed, there was a stable flame but very small.

3:10 PM	No. 1 gun pressures - CWF - 60 psig Atomizing Air - 110 psig
3:15 PM	Don MacDonald reported the repair of the two rail cars had been completed. It was agreed they would not be returned until it was not known what will happen to the CWF fuel in the bunker.
3:20 PM	The operators started to bring the unit on-line.
3:30 PM	The unit was on-line.
3:36 PM	Trying to put the No. 4 Burner in-service with Forney/H.O. gun.
3:38 PM	Gun in No. 4 Burner removed because it was plugged.
3:45 PM	Gun replaced in No. 4 Burner.
4:00 PM	CWF/NRC gun in No. 1 Burner was removed so the tip could be changed from one with a 60° tip, to one with a 70 ° angle.
4:15 PM	CWF/NRC gun in No. 1 Burner replaced with a new atomizer tip with the wider spray angle.
4:17 PM	Ignitor in No. 1 Burner removed, and the CWF flame remained stable, with a larger flame.
4:22 PM	The flame (with 70° tip) looks wider than the previous flame (with 60° tip).
4:26 PM	The bottom of the furnace is still clean but the (70° tip) flame is giving off some fireflies. Kelly thinks this can be cleaned up by adjusting the atomizing air.
NOTE:	Flame temperatures with CWF are in the range of 1150°C to 1250°C and for oil flames about 1500°C.
4:40 PM	No. 4 gun with H. oil removed because of plugging (it would seem it had not been correctly cleaned before being installed)
4:44 PM	CWF flame temperature now 1200°C (70° tip).
4:47 PM	The secondary combustion air vanes on Burner No. 4 are not at the required angle for the Forney/CWF gun - they have been reset for the NRC/CWF gun.

4:50 PM Two guns in-service: Burner No. 1 NRC/CWF
Burner No. 2 Forney/HO

5:06 PM The combustion air deflector on the end of the NRC/CWF gun was adjusted to try and improve the flame position.


20" INSIDE DIA OF THROAT
ATOMIZER TIP
℄
AIR DEFLECTOR
ADJUSTABLE HOLES
AIR DEFLECTOR

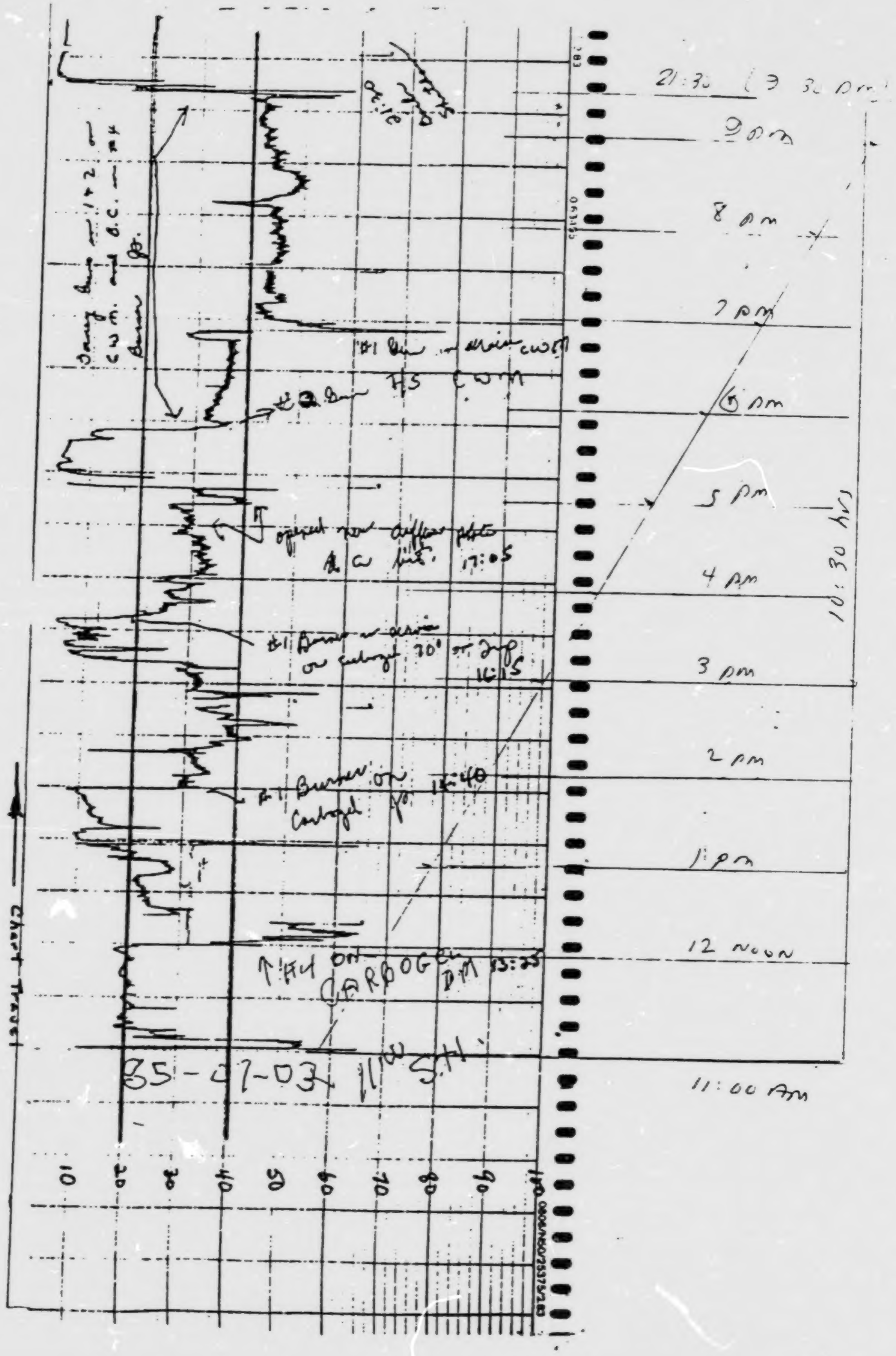
5:55 PM The test was stopped because the adjustable holes had been opened up too much, allowing too much air through.

6:00 - 9:00 PM Two CWF guns were in-service to burn up some of the CWF fuel.

M. R. Thanisch

M. R. THANISCH
Project Engineer

MRT/gem


21:30 (9:30 pm)
9 pm
8 pm
7 pm
6 pm
5 pm
4 pm
3 pm
2 pm
1 pm
12 NOON
11:00 Am
10:30 hrs
Shut down 21:10
Taking burner #1+2 on CWM and A.C. — Burner fo.
#1 Burner in service CWM
#2 Burner HS CWM
opened new diffuser plate A.C. line 17:05
#1 Burner in service on Carbogel 30° on Damp 16:15
#1 Burner on Carbogel fo 12:40
↑ #1 on CARBOGEL PM 13:25
85-07-03 11:00 S.H.
Chart Travel
10
20
30
40
50
60
70
80
90
100

File: CWF 4 Chatham
Coal Water Burner Development
NRC TEST BURN - SITE VISIT
Date: 4 JULY 85

NRC TEST BURN

1985

672-44000-E 00604

PREPARED BY: K.C. BROWN
JULY 4/85

JULY 4/85

The No. 1 boiler was up to 100 psig steam drum pressure at 8:00 A.M.

The testing crew were ready to start testing the modified No. 1 burner on carbogel.

An adjustable swirler had been added to the main atomizer just ahead of the support spider that aligns the atomizer and No. 2 fuel oil ignitors. This swirler consists of two slotted plates that can be adjusted from the face of the boiler to provide a blockage of air to the atomizer tip of 15 to 35 per cent. It is fixed to the atomizer by 3 set screws.

At approximately 8:40 A.M. the swirler plate was accidently knocked off the atomizer as the test crew was attempting to position the light oil ignitor. Although the swirler could be retrieved from the bottom of the furnace, it ~~cannot~~ COULD NOT be reinstalled until the boiler had been ~~is~~ shut down and force cooled to allow reinstallation from ~~within~~ inside the boiler.

A consideration was made to install the swirler from outside the boiler enabling the boiler to stay on line. Although the burner, ignitors and face flange ~~can~~ could be removed, the alignment spider would have to be cut from the burner throat. After reinsertion of the main burner gun with the swirler, the igniters and spider, the spider would have to be repositioned and welded. This was not possible from the face of the boiler.

A decision was made to shut the unit down in order to salvage time ~~on~~ for the pursuit of the first priority which was to demonstrate the firing of carbogel on the modified burner No. 1. It was determined that by taking the boiler off line and force cooling it, testing could resume optimistically in the early evening and for certain first thing

.../2

July 4/85 (con'd)

in the morning

The alternate to this decision was to fire oil in No. 1, and oil or carbogel in No's 2, 3, & 4 (respective of opacity levels) in order to deplete the carbogel in the bunker. It was unanimous that although the inventory of carbogel could be reduced, there would be no value from a test point of view in that sufficient data has already been obtained from firing the atomizers in the Forney burners and the guns were of insufficient capacity to provide performance runs.

The boiler was not sufficiently cooled to allow the swirler assembly to be reinstalled at the close of the day shift so reinstallation of the swirler was to be done in the evening and the boiler fired up for resumption of tests in the morning.

I asked Raymond McCarthy to have the light fuel oil meter installed as soon as possible. The meter has been calibrated and is currently in the Instrument Shop.

Raymond is also to instruct the Lab. staff to collect two samples of the ash in the bottom of the furnace and store them for future analysis. This ash accumulated as a result of Wednesday's tests.

A review of the operating reports on current testing was made and a reconciliation of questioned charges to the project was made.

Raymond is to review the labour sheets and advise K. Brown of those charges that are directly incurred as a result of the burner throat modifications on Unit 1. He will also review along with Keith the charges for fuel that likewise should be charged directly to the burner throat modifications.

File: CWF 4 Chatham
Coal/Water Burner Development
NRC TEST REPORT
Date: 5 July 85

REPORT ON MEETING FOR THE CHATHAM - N.R.C. BURNER TEST PROGRAM

Location of Meeting: NB Power's Chatham T.G. Station

Date: 5 July '85

Time: 8:30 A.M. to 10:30 A.M.

Subject: NRC/EMR Test Program for the week of July 2 to 5, 1985

People Present -

Dr. Willy Thayer	NRC
Dr. Kelly Thambimuthu	EMR
Dr. Kevin Johasson	NRC
Dr. Adam Bennett	NRC
John	NRC
Bob Kazmal	CBDC
Dave Lawrence	CLM Technologies
Don MacDonald	NB Power
Keith Keoughan	NB Power
Peter Carlisle	NB Power
Mike Thanisch	NB Power

Items Covered -

1. The week's testing was reviewed:

Tues., July 2/85 No Burning because the deflector for the end of the NRC gun had not arrived from CLM Technologies in Halifax.

Weds., July 3/85 -The Deflector arrived at 4:00 A.M. and after being installed the unit was in service ready for testing the NRC gun by lunch time (see Mike Thanisch's Site Reports for details).

-Two NRC atomizer tips were tested with 60° and 70° angles.

-Two Forney guns were in service from 6:00 P.M. to 9:00 P.M. to burn up some of the CWF. The unit had to be shut down at 9:00 PM because of poor weather conditions.

Thurs., July 4/85 -No burning because the deflector plate was knocked off the end of the gun while someone was trying to adjust it.

-The whole boiler had to be cooled down before the defector plate could be replaced.

-By the early evening when the unit was ready to run again the weather conditions were not suitable to burn CWF.

-Don MacDonald had already received a couple of complaints because of fall out while burning CWF.

Fri., July 5/85 -The NRC and EMR people had to leave on the noon flight so there was not sufficient time to do any meaningful work on their test program.

-Two Forney atomizer guns were in service for a short time, with what looked like very good fires. One in Kelly's modified burner throat (Burner No.#1) and one with Adam's new swirler. (Burner No.#4)

-Later the unit had to be shut down because of high opacity readings, up to 40%.

2. Next a review was made of what work is still to be done to complete the test program.

   a- Put a Forney atomizer and gun in service, first in burner no. 1 and then in no. 4 and used the NRC monitoring equipment to check the fuel and atomizing air flows to the gun at different boiler loads.

   b- 60° and 70° NRC tips have been tested.

   c- 80% tip is still to be tested.

   d- Further testing is required with Kelly's modified burner throat.

   e- The adjustable deflector plate (block body) requires further testing to determine the optimum opening size.

3. The following questions were asked:

   a- Can a bag house be obtained to clean up the flue gas and thereby reduce the opacity from the stack?

   b- Would NB Power be willing to install an extra storage tank of between 200 ton and 400 ton capacity so different fuels could be stored and tested at the Chatham Plant?

4. Dr. Thayer reported there will be a meeting at NRC's office in Ottawa on Monday afternoon (1:00 P.M.) July 8, 1985 to review the project, and they felt NB Power should have someone there

5. The meeting finished at 10:30 A.M.

Prepared By

M.R. Thanisch

M. R. Thanisch
NB Power

File: CWF: 4 Chatham
Coal/Water Burner Development
NRC TEST - MEETING
Date: 8 JULY 85

REPORT ON MEETING FOR THE CHATHAM N.R.C. BURNER TEST PROGRAM

Location of Meeting: N.R.C. Offices in Ottawa.

Date: 8 July 1985

Time: 1pm to 4:30pm

Subject: Future of N.R.C. Gun/Atomizer Development for C.W.F. and the testing of it in the Chatham Unit No.1 Boiler.

People Present:

Dr. Ed Capes	N.R.C.
Dr. Willy Thayer	"
Dr. Adam Bennett	"
Kevin Jonasson	"
John	"
Dr. Phil Read	E.M.R.
Dr. Kelly Thambimuthu	E.M.R.
Dr. Horace Whaley	E.M.R. Canmet
Bill Pearson	E.M.R.
Mike Thanisch	N.B. Power

Items Covered:

1. Coal Water Fuel Now At The Chatham Plant.

a) Horace Whaley reported he had spoken to C.E. Canada and they would be only to pleased to burn some Cape Breton CWF (Carbogel) during their burner test program, so long as there was no charge for the fuel.

b) Bill Pearson reported Adrian White of C.B.D.C. had insisted the three rail cars (which presently have CWF in them) must be returned to CBDC empty on or before July 17/85.

As the Chatham Plant has neither any more available storage capacity, or the time to burn more CWF there is no way they can accept delivery of the three rail cars of CWF, presently on the rail siding in Newcastle, N.B.

It was agreed N.B. Power (Mike Thanisch) would contact C.G.T.X., the company who had leased the rail cars to C.B.D.C., and arrange to take over the leasing of the cars as of August 1/85. Horace Whaley said N.B. Power could bill EMR/Canmet for the cost of rental and cleaning of the cars as part of extra cost for testing the burner throats modifications because it is this extra work which has delayed the burning of the CWF now in Chatham.

c) If this was not acceptable (Item b) N.B. Power will ask C.G.T.X. if the two uninsulated rail cars now in Chatham could be leased and used for fuel storage.

d) If the CWF can be neither stored or burnt in the Chatham Plant an alternating user of the fuel will have to be found.

2. Test work completed so far:

FOUR
~~Three~~ tests of the NRC gun/atomizer have been held so far:
October 15/84
May 12/85 ← JUNE 18-22/85
July 3/85

From these test the following data has been obtained.

a) The required information to scale up the present guns from 20 x 10^6 BTU capacity to the required 56 x 10^6 BTU for the Charlottetown project.

b) The (Carbogel) CWF burnt better with the fuel pre-heated to 60°C.

c) N.R.C. manifold worked well for measuring fuel and atomizing medium flows.

d) The swirlers on the forney gun modified by N.R.C. worked well.

e) The burner throat modification proposed by Kelly Thambimuthu shows promise of improving the over all burning of both the CWF and heavy oil in the unit no.1 boiler. But it still requires some more on line development work at the Chatham plant.

3. Large CWF Gun

Willy Thayer reported he could have a large gun, with a capacity of 56 x 10^6 BTU ready for testing in unit no.1 at the Chatham Plant by late August 1985. After successful testing of this gun, he would build a set of fours guns so a complete efficiency test could be carried out on the unit.

4. Dust Collection

The test program at the Chatham plant last week had to be cut short because of high opasity readings and complaints from a couple of people close to the plant.

The following items will be checked to overcome these problems:

a) The leasing of a small bag house or precipator for use on unit no.1.

b) Investigate a method to overcome the high opasity on unit no.1.

c) Layout a detailed schedule to complete the N.R.C. test program.

5. The following work is still to be done at the Chatham Plant as part of the NRC/EMR programs:

   a) OXCE test program is planned to run from July 15 to late August 1985.

   b) Further testing of the burner throat modifications.

   c) After the OXCE test the new larger N.R.C. burners will be ready for testing.

6. Dr. Thayer asked if N.B. Power would be willing to install additional CWF storage capacity if the plant is to be used for future test programs. so that different fuel could be stored and blended. For example, delivery could be taken of the OXCE fuel now in transit to Chatham without having to dispose of the Cape Breton CWF first, if there was an extra separate storage tank at the plant.

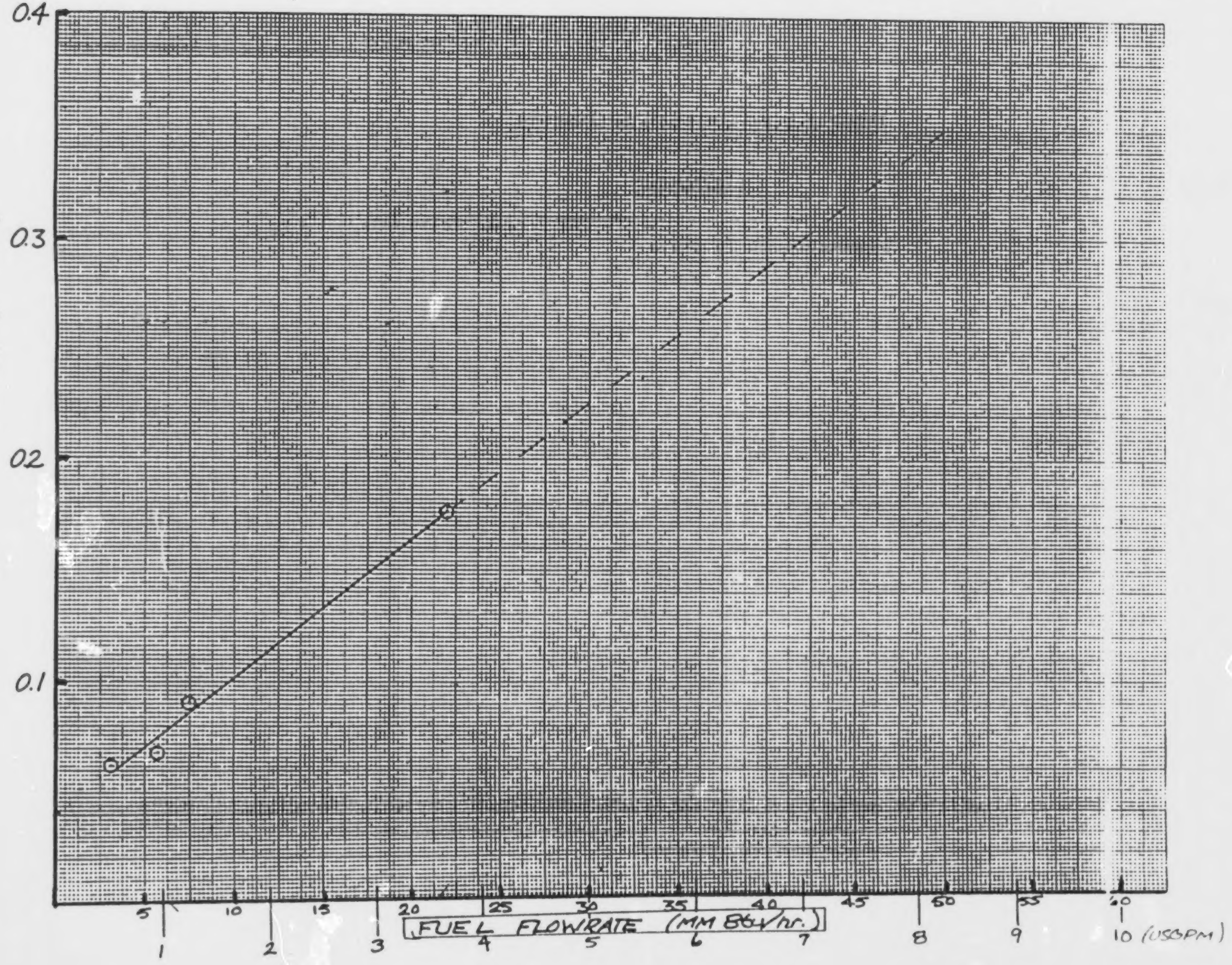
The meeting finished at 4:30pm.

Prepared By

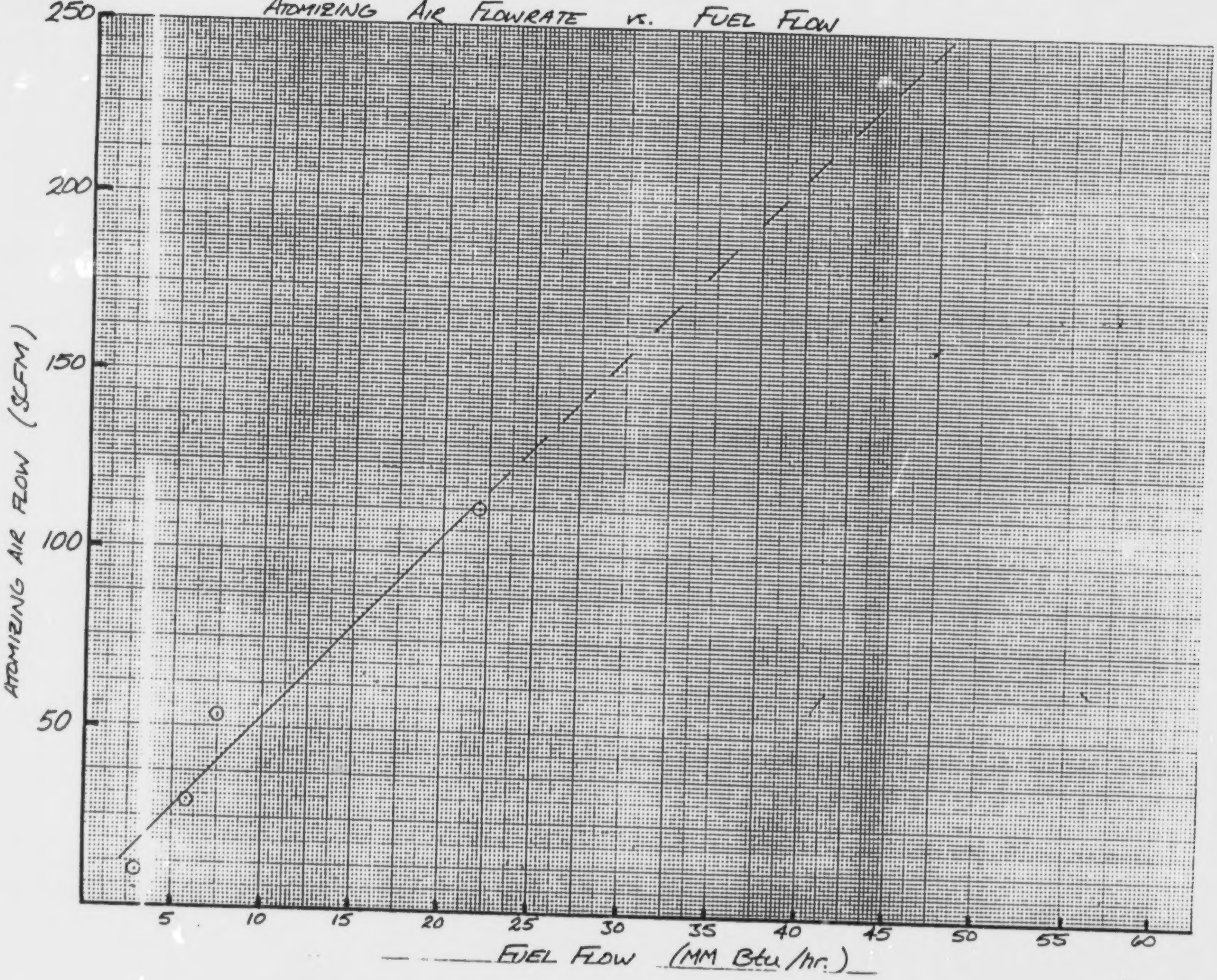
M.R. Thanisch

M. R. Thanisch
Project Engineering
Co-ordinator
N.B. Power

NRC COAL WATER ATOMIZER ANNULAR DISCHARGE AREA VS FUEL FLOWRATE



NKC COAL WATER ATOMIZER
ATOMIZING AIR FLOWRATE vs. FUEL FLOW



File: CWF-4-Chatham
Coal Water Burner Development
NRC Test Program
Date: 17 July 85

REPORT ON MEETING FOR THE CHATHAM NRC BURNER TEST PROGRAM

Location of Meeting: N.B. Powers' EMO Room, 9th Floor

Date: 17 July 85

Time: 1:30 p.m. to 3:00 p.m.

Subject: Method to overcome the Environmental problems when burning C.W.F. in unit No. 1 at the Chatham Plant.

People present:		
	Chuck Baird	Jeff Jones
	Victor Clark	Chris Doiron
	Leo Burns	Dave Rankin
	Mike Thanisch	Phil Whalen

Items covered:

1) Stack - methods to improve the performance of the existing stack.

a) present velocity of flue gas from the Chatham Stack at full load;

Unit No. 1	12 Fps
Unit No. 2	20 Fps
Unit No. 1 & No. 2	32 Fps

b) this should be increased to between 80 and 100 Fps
c) temp of flue gas - 170°C
d) plume rise - ~~4~~ 8 times the velocity will give approximately twice the plume rise
   - increase in the gas temp will also increase the plume rise
e) area of distribution - with improved plume rise the area of distribution will be increased but with a much reduced concentration of fall out at any single location.
f) method to increase flue gas velocity
   - this can be obtained by adding a nozzle at the top of the stack to reduce the outlet diameter - the pressure drop would be about 1 to 2" WG.
g) cost of nozzle - Mike Thanisch will obtain an estimate for its manufacturing and installing the stack nozzle.
h) I.D. fans - check to find out if the existing I.D. fan can handle the increase load.

- can the capacity of the existing I.D. fans be increased?

i) Stack - have a new inspection done on Chatham

j) Schedule - make up a schedule to have this work completed so NRC test can completed in late August.

2) Operating Conditions

a) opacity meter - the existing meter will be checked and recalibrate for the new stack nozzle size.

a) oil guns - either heavy oil main guns or light oil ignitor guns will be used if the opacity goes too high while burning CWF.

c) weather - test work will only be carried out when the weather conditions are acceptable.

3) Increasing Air Flow in Stack

a) Unit No. 2 fans -the air flow in the stack could be increased when Unit No. 1 is in-service burning CWF by running the unit No.2 fans. This will be tried but it was felt the effect of the increased velocity will be off set by cooling the flue gas with the cold air from Unit No. 2 fans.

b) air heater in the bottom of the stack:
it was felt to have a significant effect on the plume rise a very large volume of heat would be required, as the flue gas temperature would have to be increased 4 to 8 times double the plume rise.

4) Propane ignitions on Unit No. 1

a) check to find out if there are any code restrictions (provincial or I.F.P.A.)

b) can a ring type ignitor be used?

c) how would the existing ignitors be converted, or would new guns be required.

d) can the propane tank installed for the low NO_x burner be used?

5) Re-injection of the fly ash

a) as the fly ash collected during the No. 2 CWF test burn was - very high in unburnt carbon could it be reinjected into the boiler? It was felt this would be well worth investigating once improved methods of collecting the fly ash has been found.

6) Bag house - a module design will be investigated so that it can be added to as required

- once the test programs at the Chatham Plant have been completed the bag house would be moved to one of the Grand Lake Units.

7) Addition of Line - work is presently being done by one fuel manufacturer on mixing line with coal water fuels (CFW) to capture some of the sulphur in the coal while it is being burnt. It was felt this should be investigated as it would not only improve sulphur reduction but could also improved on the fly ash collection.

8) Next Meeting - a meeting will be held on Wednesday July 31, 1985 at 1:30 p.m. in the E.M.O. Room to review what progress has been had to overcome the environmental problems at the Chatham Plant while burning coal water fuel.

M.R. Thanisch

Prepared by: Mike Thanisch

c.c. Files
Those present

ENERGIE NB POWER

NOTICE OF MEETING

PROJECT: Chatham CWF 4

FILE NO.: CWF 4

ARRANGED BY: M.R. Thanisch
P.J. Whalen

TEL. NO.: 3038

DATE: July 17, 1985

SUBJECT: To review the Chatham CWF Environmental problems

LOCATION: EMO Room HO 9

DATE: July 17, 1985

TIME: 1:30 PM

PERSONS INVITED:

C.F. Baird	HO 8F
P.J. Whalen	HO 9A
D.M. Rankin	HO 4B
C.C. Doiron	HO 4D
D.B. MacDonald	Chatham Plant
M.R. Thanisch	HO 3C

PERSONS INFORMED:

AGENDA:

1) Review problem at the Chatham Plant when burning coal water fuel in Unit No. 1.

2) Proposed methods to overcome this problem:
    a) Run No. 2 boiler fans when boiler No. 1 is burning CWF.
    b) Open door at bottom of stack.
    c) Install a heater in bottom of stack.
    d) Add a nozzle on top of stack.
    e) Lease a baghouse.
    f) Can the performance of the existing dust collectors be improved.

3) Layout detailer schedule to complete the EMR/NRC test program, on Unit No. 1 with a minimum of operating hours.

FORM NO. 52

ACKNOWLEDGEMENT: PERSONS INVITED ARE REQUESTED TO RETURN A SIGNED COPY OF THIS NOTICE TO ________________ INDICATING WHETHER OR NOT THEY WILL ATTEND.

☐ WILL ATTEND ☐ WILL NOT ATTEND ☐ DELEGATE WILL ATTEND PERSON ________________ DATE ________________

31 July 1985
CWF 4 Chatham Coal Water -1.0
Burner Development
Chatham Test Burns
NRC - TEST

REPORT ON MEETING FOR
THE CHATHAM NRC-OXCE
TEST PROGRAMS

Location of Meeting: N.B. Power's, EMO Room, 9th Floor

Date: 31 July 85

Time: 1:30 PM to 2:45 PM

Subject: Completion of the test programs now being worked on at the Chatham Plant

People Present:
- Dave Rankin
- Rod Pickles
- Leo Burns
- Mike Thanisch

Items Covered: (See Attached Agenda)

1. Minutes July 17/85 meeting were reviewed and two small correction made.

   Corrected minutes will be issued with this report.

2. Fuel in Bunker:

   - Approx. 150 tons in Bunker (See attached report from Francine)

   - This is equal to 100 tons of coal

   - Ship the fuel (CWF) to an N.B. Power Coal Burning Station

   a) Dalhousie 11 (the Unit No.2 is off line)

   b) Grand Lake - This station could burn the CWF quite quickly once it was mixed with their coal pile.

   c) Approval would be required from the plant manager before anything could be done.

3. Disposal of (CWF) fuel now in the Chatham Bunker

   a) First, if the fuel (CWF) can be re-mixed, the Chatham Plant will try to burn it in Unit No.2 with support ignition.

   b) Disposal on a coal pile . See 2C.

4. Propane - There seems to be no major problems with burning propane at the Chatham Plant.

   - Department of Labour have been contacted.

   - Two suppliers have been contacted for more details.

   - A sketch of propane nozzle has been received from Forney Engineering Co., the Designer of the Unit No.1, CWF Burner.

5. OXCE-Burn

   - Burn "Rail-Tank-Train" first.

   - So far it is only planned to burn the fuel (OXCE-CWF) in Unit No.2.

   - Only one car of fuel will be unloaded at a time.

6. Stack Nozzle

   - Prilimary Report received on the Chatham Stack
     a) The top 15 feet are in poor conditions.

     b) The Liner is in poor condition.

   - Only one price has been received so far of the three companies contacted for quotations for a stack nozzle.

   - Once details of the nozzle is known it will be checked with new unit No.3 Boiler,Fan Design.

7. Dust Collector

   - Approximately 6 months is required to installed a dust collector.

   - Cost $ 300,000.00 to $ 600,000.00.

   - Unit No.1 only.

   - Unit No.2 could use Unit No.3 dust collector (Bag House) by adding extra breeching.

   - Future Fuels will be taken into consideration (ie. CWF, Coal, Bunker Oil, Crude Oil etc.).

   - Future Test Programs will also be taken into consideration - would there be a cost shearing?

- Check into the Bag House in Minto that was installed for the Charcoal Plant that has gone out of business.

8. Completion of the N.R.C.

- The running of the Unit No.2 fans when Unit No.1 is on line may over cool the flue gas.
- A nozzle may still be the only quick answer.
- A Bag House would be a long term answer.

The meeting closed at 2:45 P.M.

Prepared by

M. R. Thanisch

1985-07-31

File: CWF-4 CHATHAM Coal/Water
Burner Development
OXCE - Test Program

AGENDA FOR MEETING ON THE CHATHAM C.W.F. TEST PROGRAMS

DATE: July 31, 1985

LOCATION: EMO Room - 9th Floor

TIME: 1:30 p.m.

ITEMS TO BE COVERED:

1. Minutes of Meeting on July 17, 1985
2. CWF (Carbogel) now in bunker
3. Disposal of Fuel
    a) Burn
    b) Put on a coal pile
4. Propane Ignitors
    a) Unit No.1
    b) Unit No.2
5. Burning OXCE Fuel
6. Stack Nozzle
    a) Unit No.1
    b) Unit No.2
    c) Unit No.3
7. Dust Collector
    a) Unit No.1
    b) Unit No.2
8. Unit No.1 NRC Burner Test Program

Prepared by:

M. R. Thanisch

ld

File: CWF-3/4
OXCE Test - Fuel
NRC Test - Fuel

1985-09-24

VISIT TO THE CHATHAM T.G. STATION ON

Tuesday, September 24, 1985

SUBJECT: Upcoming Test Burns

DETAILS:

1) OXCE Test - Fuel

I had a meeting with Don MacDonald and Jack Flanagan on the burning of the 100 tons of OXCE fuel now in the bunker while they are recommissioning the Unit No.2 turbine. The No.2 boiler will have to be in service to supply steam to the turbine. So there would be a considerable cost saving for the Plant if they burn as much OXCE fuel as possible, rather than using heavy oil which they would have to replace.

Both Don and Jack agreed they will try to burn all the OXCE fuel now in the bunker. Not only to get rid of it but also to find out if the other OXCE fuel (still in rail cars) could be economically burnt; ie. the cost of support oil would be less than the energy credit received by the project for the electrical power generated.

I also went over the advantages of burning the OXCE fuel in the Unit No.2 boiler with Keith Keoughan.

2) NRC Test - New Burner Testing

- I reviewed with Don MacDonald and Jack Flanagan, our plans for testing the new NRC Burner/Atomizer in the No.1 boiler next week (September 30) on carbogel CWF.

  A small amount of carbogel will be unloaded into a temporary day tank (400 gallon capacity) located next to the Unit No.1 burner front. This is to allow the CWF to be supplied directly to the NRC flow control manifold and pump.

- I left a copy of the enclosed sketches with Don.

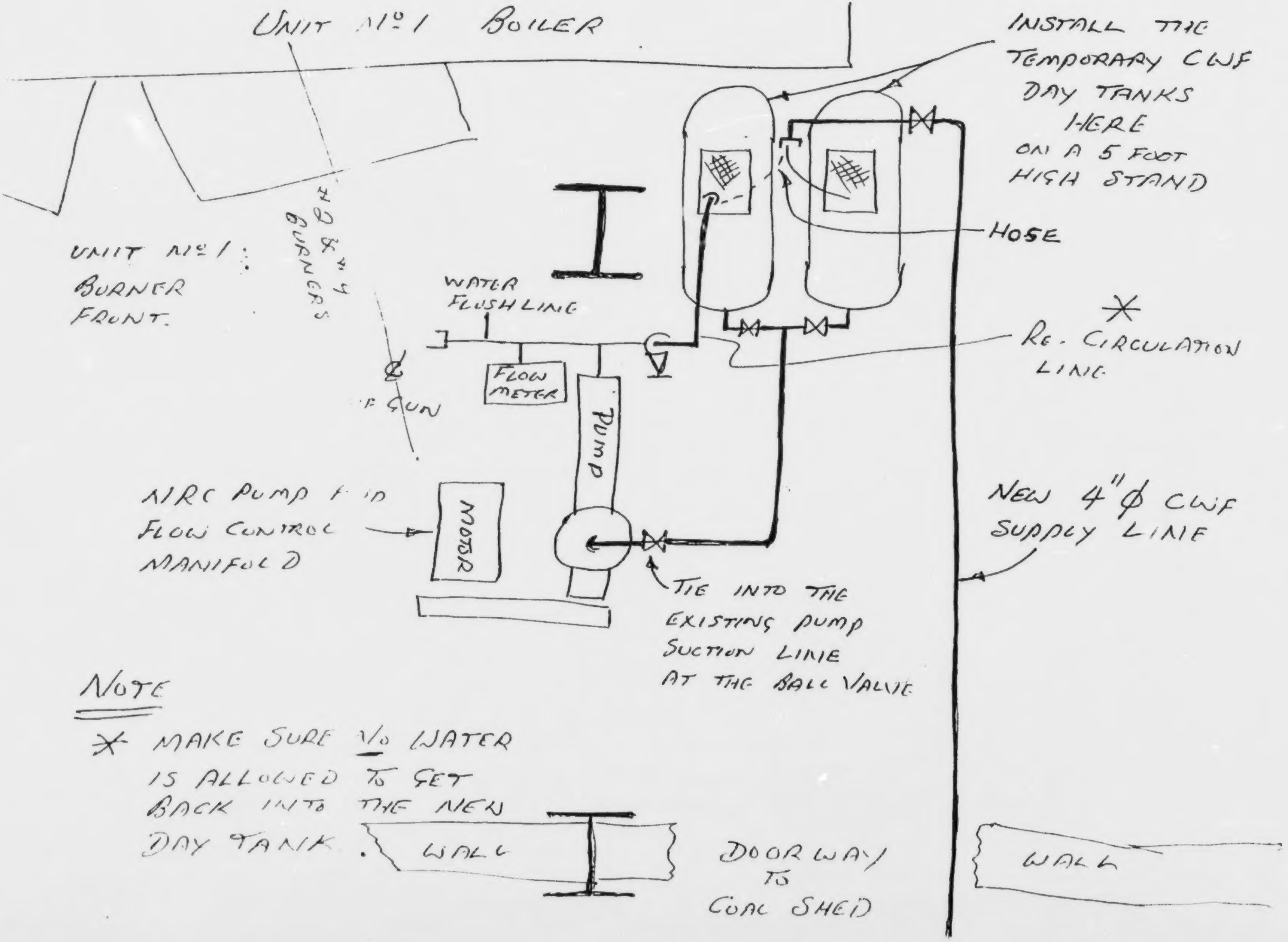
- I also reviewed the required work with Richard Weeks and gave him copies of the sketches.

- Joe Young ordered two, 200 gallon tanks to be used for the day tank, and we checked the Stores to ensure there was sufficient material for the temporary supply line.

ld

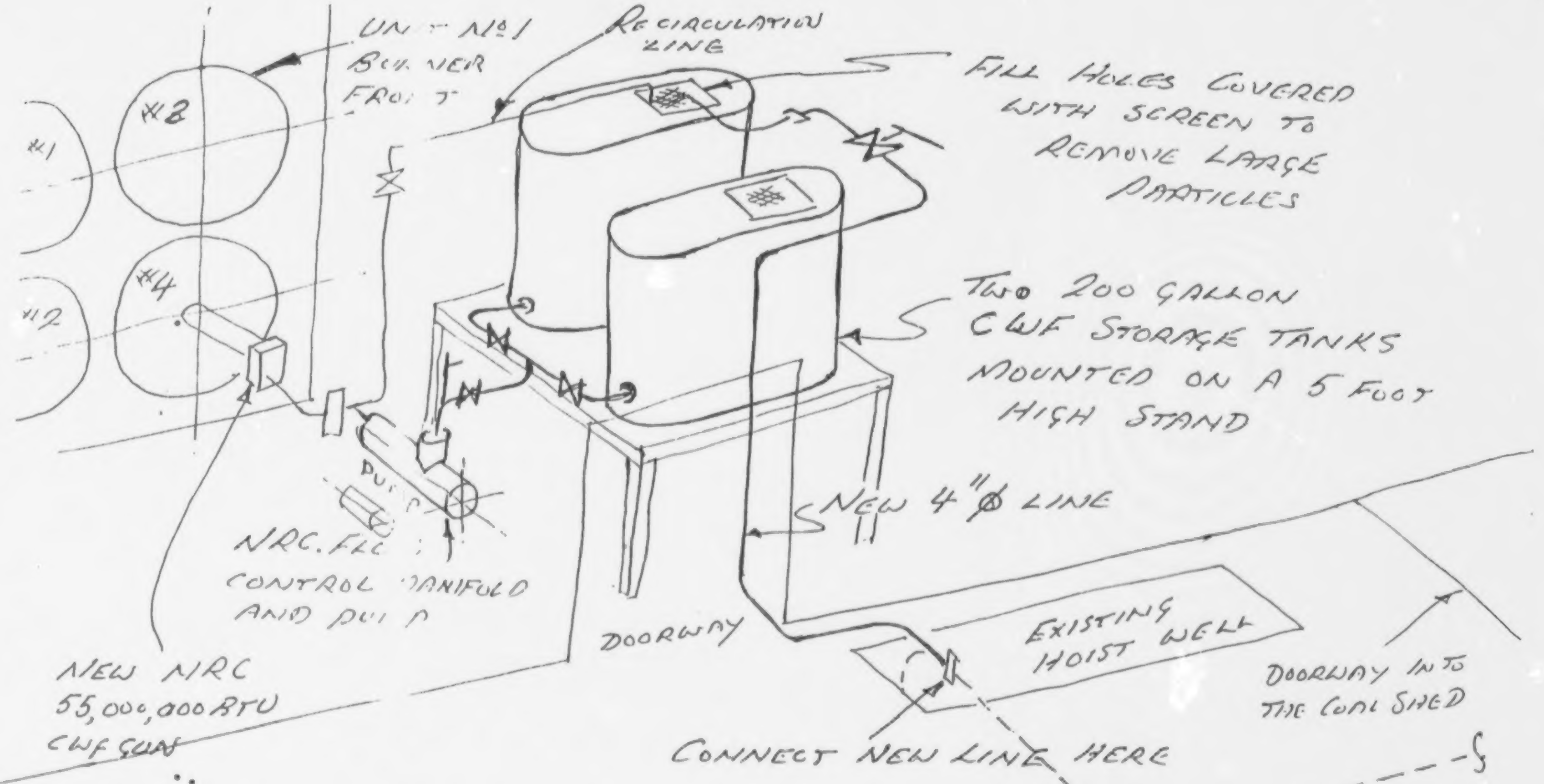
M. R. Thanisch

M. R. Thanisch


UNIT No 1 BOILER
INSTALL THE TEMPORARY CWF DAY TANKS HERE ON A 5 FOOT HIGH STAND
HOSE
#2 & #4 BURNERS
UNIT No 1 BURNER FRONT.
WATER FLUSHLINE
FLOW METER
PUMP
P GUN
*
RE- CIRCULATION LINE
NRC PUMP F ID FLOW CONTROL MANIFOLD
MOTOR
NEW 4" Ø CWF SUPPLY LINE
TIE INTO THE EXISTING PUMP SUCTION LINE AT THE BALL VALVE
WALL
DOORWAY TO COAL SHED
WALL

NOTE

* MAKE SURE NO WATER IS ALLOWED TO GET BACK INTO THE NEW DAY TANK.


UNIT No 1
BURNER
FRONT
RECIRCULATION
LINE
FILL HOLES COVERED
WITH SCREEN TO
REMOVE LARGE
PARTICLES
#1
#2
#2
#4
TWO 200 GALLON
CWF STORAGE TANKS
MOUNTED ON A 5 FOOT
HIGH STAND
PUMP
NEW 4" Ø LINE
NRC. FLOW
CONTROL MANIFOLD
AND PUMP
DOORWAY
EXISTING
HOIST WELL
DOORWAY INTO
THE COAL SHED
NEW NRC
55,000,000 BTU
CWF GUN
CONNECT NEW LINE HERE
EXISTING CWF
UNLOADING LINE
FROM RAIL SIDING

NOTE: THE DAY TANK COULD ALSO BE LOCATED IN THE COAL SHED.

TEMPORARY DAY TANKS
FOR TESTING THE NEW NRC GUN
ON SEPT 30/85 TO OCT 4/85

RECORD OF TELEPHONE CONVERSATION

FILE NUMBER: CWF 4
NRC Test - Program

DATE: 23 Sept. 85

TIME: 10:30 am

CALL FROM: Bill Pearson

FIRM: E.M.R. - Ottawa

RECEIVED BY: Mike Thanisch

FIRM: N.B. Power

GENERAL TOPIC OF CONVERSATION:

Testing of the new larger NRC - C.W.F. Gun/Atomizer

SYNOPSIS OF DISCUSSTION:

Bill reported:

- N.R.C. will be traveling to Chatham on Monday, Sept. 30/85 to test one of their new and larger CWF Gun/Atomizer.

I told Mr. Pearson some Carrogel C.W.F. will be available at the N.R.C. flow controls manifold next to Unit No.1 ready for their test program.

M.R. Thanisch

File: CWF 4 Chatham
Coal/Water Burner Development
Testing of New NRC Gun

November 18, 1985

REPORT ON SITE PROBLEMS
THE WEEK OF NOVEMBER 12 TO 15/85

Tuesday, Nov. 12/85:	All day was spent reworking some of the Carbogel fuel which had settled in the rail car, and treating it with the chemicals which were available at the Chatham Plant.
Wednesday, Nov. 13/85:	Jack Flanagan the Operations Supervisor at the Chatham Plant, reported they had developed a leak in the No. 1 boiler while the unit was being brought into service, ready to test the NRC gun/atomizer with the reworked fuel.
Thursday, Nov. 14/85:	The site reported they were still working on the boiler tube repair, and the NRC personnel had returned to Ottawa.
Friday, Nov. 15/85:	The Chatham Plant personnel were still working on the boiler tube repairs.
Monday, Nov. 18/85:	The boiler repair had been completed over the weekend and the unit was in service burning the reworked CWF fuel in two burners (No. 1 and No. 4).

Prepared by

M. R. Thanisch

M.R. Thanisch
Project Engineering Coordinator

cc: D.M. Rankin - Project Manager

1985-11-21

File: CWF-4-5-1 CHATHAM Coal/Water
Burner Development
NRC Test - Fuel

REPORT ON SITE VISIT

LOCATION: Chatham T.G. Station

SUBJECT: Re-working of the 3 rail cars of settled Carbogel fuel

DATE: November 19 and 20, 1985

PEOPLE MET WITH: Greg Landry
Cyril MacNeil - both from CBDC Carbogel Production Plant

DETAILS:

Tuesday - November 19, 1985

I arrived at the Chatham Plant and found Unit No.1 in-service burning the carbogel fuel the N.B.Power site staff had reworked earlier in the month.

As the NRC people had not arrived, the plant personnel were using the original Forney gun/atomizers.

After lunch, I had a meeting with Greg Landry and Cyril MacNeil, both of CBDC, who had come to the Chatham Plant to assist N.B.Power's site personnel with the reworking of the two remaining cars of CBDC's carbogel fuel (at the Chatham Plant).

The two CBDC people had arrived with no prepared plans on how they were going to proceed with this work - even though these people had been supplied by CBDC to N.B.Power as experts in reworking problem fuel.

The CBDC people brought their 'Rhoemat ' viscosity meter with them but no equipment to actually rework the settled fuel, and had not requested any preparations to be made in advance of their coming to the Chatham Plant.

Initially the CBDC people ~~only~~ wanted to do all the chemical additions to the fuel once it was in the in-plant storage bunker but were told this was impractical for two reasons:

1) N.B.Power could not keep the carbogel in suspension once it had been remixed with air lances, therefore, something had to be added to the fuel while it was still in the rail car, so it could be unloaded.

2) New untreated fuel could not be added to a bunker with reworked fuel already in it.

During their first full day at the Chatham Plant, the CBDC people did some testing on samples of the carbogel fuel, and issued instructions for N.B.Power's nightshift personnel to add B-3 dispersant to the second rail car of remixed carbogel fuel.

But they had:

- no procedures for reworking their settled fuel;
- no plans how the work would be carried out;
- no equipment to rework their fuel;
- no C-13 stabilizer had been supplied to N.B.Power.

Wednesday - November 20, 1985

The CBDC people did some more testing of the fuel and gave N.B.Power a handwritten report but they refused to issue to N.B.Power, any procedures or chemicals for the treatment of either of the remaining two cars containing the settled carbogel fuel (N.B.Power had reworked the first car of fuel earlier in the month).

The CBDC people removed from N.B.Power's Chatham Plant, without obtaining N.B.Power's approval, all the B-3 dispersant which had been at the Chatham Plant since 1983. (N.B.Power did not find out about this until the following day).

The CBDC people left the Chatham Plant because they claimed they had reached the cost ceiling of N.B.Power purchase order with their company. They refused to return to site even when N.B.Power offered to issue then a second P.O. for $800.00 to cover their labour cost to add the C-13 to the second partly treated car of carbogel fuel.

The first car of reworked fuel had been burnt by Wednesday afternoon and as the partly treated car of fuel had remixed quite well, the plant personnel unloaded it on the nightshift.

I left the Chatham Plant Wednesday evening to be able to report all the problems to the Project Manager the following morning.

M. R. Thanisch

ld

M. R. Thanisch
Project Engineering Co-ordinator

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
INTERNAL CORRESPONDENCE

1985-11-29

PLEASE REFER TO OUR FILE NUMBER..............................
C.W.F. 4 Chatham NRC Test

MEMO TO: Dave Rankin
Project Manager

SUBJECT: Summary Report for N.R.C. Test Burn
The Week of November 18 to 26/1985

CONCLUSION:

This program proved to be an excellent test of the three N.R.C. gun/atomizers, because the three rail cars of settled Carbogel fuel were reworked separately using different methods. This resulted in the gun/atomizers being tested with fuels of different qualities.

The three guns were:

1. The small C.W.F. gun/atomizer, burning heavy fuel oil. This unit was judged to have a better oil flame than the oil guns supplied with the Forney burners.

2. The medium size C.W.F. gun/atomizer, which NRC had modified since their earlier testing at the Chatham Station. This gun was run at 20×10^6 BTU/hour and was reported to have the best CFM flame seen during all the Chatham CWF burns.

3. The new large C.W.F. gun/atomizer which was run at various loads, between 40×10^6 and 56×10^6 BTU/hour. The opacity from the No. 1 boiler was reduced by 50% when the Forney C.W.F. gun was replaced by this gun.

DETAIL DISCUSSION:

The first rail car of settled Carbogel fuel was remixed in the rail car by N.B. Power's site personnel using long air lances. As this re-mixed but unstable fuel (there were little of the additives left in it) was being unloaded into the in-plant storage bunker 25 pounds of stabilizer (C-13) were added to it. This was about one third of the quantity (70 pounds per rail car) recommended by C.B.D.C.'s Carbogel Laboratory at Victoria Junction, N.S. The 25 pounds were all the C-13, N.B. Power had on hand, and C.B.D.C. advised they did not have a surplus in stock to be able to supply any to N.B. Power.

This fuel could not be burnt immediately as the test had to be delayed due to a problem which developed with the Unit No. 1 boiler at the Chatham Station. The fuel was re-circulated for 10 days before the test program was started.

The best C.W.F. fires were obtained with this first rail car of fuel, which had been reworked by the Chatham Plant personnel (without any on-site assistance from C.B.D.C./Carbogel).

First the reworked Carbogel fuel was test fired on Monday and Tuesday (Nov. 18/19-1985) with the original Forney gun/atomizers and unstable fires with high opacity reading were obtained.

On Wednesday (Nov. 20/85) the NRC test program was started and when the Forney guns were replaced with the NRC gun/atomizers there was an improvement in the C.W.F. fires. After making some adjustments the opacity reading was reduced to 30% (the corrected reading was close to 15%) and stable fires without support ignitors were obtained. By Thursday morning the Chatham Plant Manager reported these fires were the best C.W.F. fires he had seen while burning any of the coal water fuels that had been supplied to the Chatham Plant.

This first rail car of fuel was completely burnt by Thursday evening (Nov. 21/85) and the second car of reworked Carbogel fuel was unloaded overnight.

The C.B.D.C. people were involved in the reworking of the fuel and they recommended a full dose of C-13 stabilizer, B-3 dispersant, and formalin be added to this rail car of fuel. They agreed to add the B-3 and formalin to the remixed fuel while it was being transferred between two rail cars but, insisted they personally add the C-13 to the fuel once it was in the bunker. This resulted in poor mixing of the fuel and stabilizer, which had an adverse effect on the performance of the burners.

This fuel was tested on Friday (Nov. 22/85) with both the NRC and Forney gun/atomizers. Again the NRC ones preformed much the better; but, the ignitors had to be kept in-service to keep the C.W.F. flame attached to the atomizer tips. This was caused by both the inconsistent viscosity and nature of this batch of fuel, due to poor mixing and its high moisture content. The high moisture content was caused by the addition of so much water, which was required to dilute the C-13 before it could be added to the fuel.

This fuel was all burnt by Saturday afternoon (Nov. 23/85) and the third rail car of reworked fuel was unloaded overnight, starting Saturday evening.

In this case, and at N.B. Power's insistance all the chemicals were added to the fuel in the rail car, and well mixed with the air lances before being unloaded from the rail car into the in-plant bunker.

The reworked Carbogel fuel was ready for firing the following morning, Sunday (Nov. 24/85). Samples taken at both the burner front and bunker showed the viscosity was much more consistent than the fuel from the previous car.

Again the ignitors had to be kept in-service to maintain stable fires. This was an expensive method to burn this coal water fuel but it was a good opportunity to run the NRC gun/atomizers for some hours to establish if they were subject to wear from the C.W.F. After being in-service for over a week there was no noticeable wear on the atomizer tips.

What also impressed the Chatham Plant operating personnel was that once the NRC guns had been set up they could be left in-service without making any further adjustments, and no plugging was experienced with these guns.

The unit was shut down Sunday night but stayed in-service on Monday (Nov. 25/85) until all the reworked Carbogel fuel had been burnt at 1:50 AM Tuesday morning (Nov. 26/85).

With the second and third cars of reworked fuel it was noted as the fuel was consumed the mixing improved (i.e., less fuel could be recirculated more quickly) and the fires started to improve.

It was felt too much of the additives had been added to the second two cars. This was based upon comparing the quality of the fires obtained from their reworked fuel, with that of the fires from the first car of reworked fuel.

It has been noted in the past the coal water fuels improved with age.

It is felt two things were going on during this maturing period for new fuel, one: the chemicals and fuel becoming better mixed and, second: some of the chemicals are lost due to both bacteria action and evaporation until the optimum level of mixing and quantity of chemicals has been obtained. When the coal water fuel is first prepared the quantity of chemicals added is a compromise between "shelf life" and good atomization.

This concluded this phase of the testing of the NRC, coal water fuel, gun/atomizers. It was agreed between the NRC and N.B. Power staff that a great deal of improvement had been made with these NRC guns and that they handled very well the three batches of Carbogel fuel, of different qualities, and varying consistencies. It was shown the new large gun/atomizer could carry a load in the 50-60 x 10^6 BTU/hour range without support ignitors, when it was supplied with a good quality fuel.

A sample of fly ash that was collected over a three day period had only 45% carbon in it, indicating that these guns had a good carbon burn out.

M R Thanisch

M.R. Thanisch
Project Engineering
Co-ordinator

c.c. Don MacDonald - Chatham Plant
Jack Flanagen - Chatham Plant

RECORD OF TELEPHONE CONVERSATION

FILE NUMBER: CWF 4 -3.0
NRC Test:Fuel

DATE: 26 November 1985
TIME: 8:15 AM

CALL FROM: Don MacDonald
FIRM: N.B. Power - Chatham

RECEIVED BY: Mike Thanisch
FIRM: N.B. Power - F'ton

GENERAL TOPIC OF CONVERSATION:

BURNING OF RE-WORKED CARBOGEL FUEL

SYNOPSIS OF DISCUSSTION:

Don reported:

- All the fuel in the bunker was burnt by 1:50 AM this morning. They had stayed on-line yesterday until the burning was completed.
- Yesterday they had tried to flush out one of the rail cars but this had not worked too well, so now they will heat the cars to dry the fuel, and then remove it dry, as they have done in the past.

Later Francine called and reported:

- The "C-Grid" fly ash samplers were installed by 2 PM on Friday (Nov. 22) and have been in-service since then.
- She was able to collect a small sample which she will test for carbon content and send the remainder to me.

M.R. THANISCH

RECORD OF TELEPHONE CONVERSATION-

FILE NUMBER: CWF 4 NRC Test : Fuel

DATE: November 25, 1985

TIME: 1:45 p.m.

CALL FROM: Don MacDonald

FIRM: Chatham Plant

RECEIVED BY: Mike Thanisch

FIRM: N.B.Power Fredericton

GENERAL TOPIC OF CONVERSATION:

Burning of Reworked Carbogel CWF.

SYNOPSIS OF DISCUSSTION:

1. There were 44 tons of CWF in the bunker at 10:00 a.m. this morning. This cannot be all burnt today and they will have to come on-line tomorrow to finish off.
2. The new fuel was tested with a Forney gun and the opacity went up. (Don cannot be sure the Forney burner settling were fully optermized).
3. The new fuel may not be mixed well enough as yet, for it was only unloaded yesterday - but it would seem there is too much stabilizer (C-13) in it. Also it is now like very new fuel and it has been found in the past the fuel improved with time.
4. Today they have two NRC guns in service at full load, with ignitors, and two heavy oil guns, at part load.
5. Don will ask the operators to try and reduce the fuel flow to the ignitors.
6. When the ignitors were removed, the No.3 burner (the medium size NRC gun) almost went out, and the flame on the No.4 burner (the larger NRC gun) moved well off the burner tip.
7. Don will check to see if the "C-Grid" fly ash sampler was installed on Friday.

M. R. Thanisch

RECORD OF TELEPHONE CONVERSATION

FILE NUMBER: CWF-4 NRC Test - Fuel

DATE: November 25, 1985

TIME: 8:15 a.m.

CALL FROM: Mike Thanisch

FIRM: N.B.Power Fredericton

RECEIVED BY: Don MacDonald

FIRM: N.B.Power Chatham

GENERAL TOPIC OF CONVERSATION:

Rework of C.B.D.C. (Carbogel) Fuel at the Chatham Plant.

SYNOPSIS OF DISCUSSTION:

Don gave me the following report:

1. Greg Landry and Cyril McNeil of C.B.D.C.(Carbogel) left the Chatham Plant at noon on Saturday, November 23, 1985.
2. All the chemicals were put in the third rail car and mixed before it was unloaded.
3. The C.B.D.C. people were having problems mixing the C-13 and were taking over two hours to mix one drum up. The Chatham Plant Chemist (Francine) was able to do the same thing in 15 minutes by using warm water. This further shows CBDC lack of experience and how poorly they were prepared before they came to the Chatham site to re-work their fuel.
4. The third rail car of CWF was unloaded starting on Saturday evening and finished at midday on Sunday.
5. The CWF with a full amount of C-13 in it is not burning as well as the fuel with little or no C-13 in it. The C-13 increased the viscosity to 400+ CPS.
6. Unit No.1 was on-line on Sunday - the opacity was low but the ignitors had to be kept in to maintain stable fires.
7. The fuel with only B-3 (and a small amount, or no C-13) had a viscosity of 250 CPS but had good and stable fires.
8. I asked Don to ensure the operators keep their log up with detailed report, and record all their boiler readings. Also they mark on the opacity chart the time and main events.
9. As yet, Don has not received a report on how empty the rail cars are but judging by the amount of fuel unloaded, there cannot be much left in them.
10. Don has made up a list of his problems with the C.B.D.C. personnel sent to Chatham, which he will forward to Fredericton.

M.R.Thanisch

RECORD OF TELEPHONE CONVERSATION

FILE NUMBER: CWF 4 NRC Test:Fuel

DATE: 21 November 1985

TIME: 4:00 PM

CALL FROM: Don MacDonald

FIRM: N.B. Power Chatham

RECEIVED BY: Mike Thanisch

FIRM: N.B. Power F'ton

GENERAL TOPIC OF CONVERSATION:

REPORT: TEST BURN

SYNOPSIS OF DISCUSSTION:

Don reported:

1. They were burning 3 ton C.W.F. per hour and had heavy oil guns, at part load in burners 1 and 2.
2. Burner No. 3, with the medium sized N.R.C. gun, had a load of 20 x 10^6 BRU/hr. with a very good flame.
3. Burner No. 4, with the new large N.R.C. gun, had a load of 40 x 10^6 BTU/hr. with a good and bushy flame.
4. The stack looked good.
5. The opacity meter reading was 30%.

   NOTE: This is 14% when corrected for the air flow from tag Unit No. 2 boiler fans.

M.R. THANISCH

File: C......... Chatham
Coal/Water Burner Development
....
Date: ....

VISIT TO THE CHATHAM GENERATING STATION

NRC DEMO + BAGHOUSE TEST

February 18 to 21, 1986

February 18, 1986

The NRC staff were to optimize their large burners on coal water fuel (air atomized) today. This plan was aborted as a result of a leak in a feed water isolating valve. This problem was discovered while bringing the boiler up to temperature on heavy oil firing.

A meeting was held between the Plant people, CANMET, NRC, PTS and N.B.Power Engineering to review the schedule of events to take place with respect to efficiency tests and baghouse tests as prepared by Mike Thanisch.

The Plant staff had assessed that the leaking valve would be repaired and that operations could resume at approximately 4:00 p.m. of that day.

Adam Bennett of NRC questionned the design of the new primary air collars provided by MBB for the four burners. His concern was that the triangular openings would only provide 5% of the air that normally passed through the primary air passage. In his view, this would limit the output of his burners on coal water fuel. Dr.Kelly Thambimuthu reviewed the air requirements and suggested that these collars should limit the air flow to 30% and to do this, would require the holes to be cut larger. The most expedient way to do this was to cut the larger holes in situ using a power cutting wheel. This required approximately 8 hours for modifying all four burner collars and was completed at approximately midnight. No work could be carried out on gun testing until this work was completed.

The plan of events for Wednesday, February 19th was to commence steaming of the boiler during the 12:00 midnight to 8:00 a.m. shift to allow NRC staff to commence optimization of the CWF guns at 8:00 a.m. and if stable fires are achieved, it was felt that efficiency tests on CWF air atomized as well as a CWF steam atomized could be accomplished by the evening of February 19, 1986.

All of these considerations and plans were made by 4:00 p.m.

In order to gain some time on the test schedule, it was decided to lime the filter bags in the baghouse.

According to Ron Birley of Air Correction, a differential of 3" Wg should be achieved to ensure a proper filter cake is developed on the filter bags. In his estimation, this could be achieved with approximately one hundred and fifty pounds of lime.

Each compartment was individually coated and fifty pounds of lime was used for each compartment. The pressure drops recorded were as follows: 0.5" Wg for the two compartments at each end of the baghouse and 0.2" Wg for the middle compartment.

A visual check was made on the bags and it did appear that the bags were uniformly coated.

February 19, 1986

The boiler was on line at 8:00 a.m. and the NRC personnel began to optimize the CWF burner in No. 4 at approximately 8:30 a.m. Heavy oil was being fired in burners No. 1 and No. 2.

Initially the CWF fire produced some sparklers but after approximately twenty minutes after being placed in operation, the flame although bushy appeared to be brighter and the opacity meter recorded opacities ranging between 20% and 22%.

At 10:20 a.m., burner No.3 was fired on heavy oil to heat up the burner port. This was done to speed up the optimizing time in the setting the burner to CWF firing.

Opacity at this point was just under 20%.

The manual primary air positioner for No.4 is still in the closed position. Adam Bennett felt that the refractory was not sufficiently hot, a situation that would allow the primary air to blow the flame off the atomizer tip. At this point, NRC personnel estmated that the burner in No.4 was producing 42 x 10^6 BTU's/Hour.

At approximately 1:30 p.m., the second CWF gun was fired in No. 3 burner. A poor fire was achieved and considerable bottom ash was being produced. The fluctuation in opacity readings ranged between 20% and 35%. The electrical output was 5.75 MWe.

At 2:00 p.m., burner No. 3 was shut down because of poor fires resulting from fuel plugging. A piece of weld that had broken free jammed between the burner gun and the guide tube which caused a forty-five (45) minute effort to withdraw the gun.

The atomizing cone was replaced and the burner was reinserted into No. 3. Poor flames were still experienced when the gun was forced beyond the 20-25 x 10^6 BTU/Hr. level.

At 5:00 p.m. a decision was made to withdraw the center of the burners in No. 3 and No. 2 and switch them so that the CWF guns would be in burners 2 and 4 and oil guns in 1 and 3. The unit was taken offline and a crew consisting of 2 laborers were directed to make the switch that evening, a procedure estimated to take 3 hours.

It was argued that the unit would be fired up at 6:00 a.m. the next day and that NRC would begin optimizing their first CWF gun at 6:30 a.m. It was determined that this early start would allow for a commencement of a performance run at approximately 10:00 a.m. in the morning.

February 20, 1986

At 6:30 a.m. the coal water fuel gun in burner No. 4 was fired. At approximately 7:00 a.m. the second coal water fuel gun in burner No. 2 was fired. During this time heavy oil was being fired in burners 1 and 3.

The opacity peaked at 40% and the physical appearance of the stack flume looked clean.

At 7:45 a.m. a vacuum problem on the turbine forced the turbine off line.

The boiler was kept at pressure for approximately two hours while efforts were made by the operations staff to locate the problem. After a check on all possible sources of the problem, it was agreed that the isolating valves to the steam air ejectors and the air ejectors themselves would be taken apart and inspected.

At this point it was unknown as to when testing could resume for there was still the possibility that the vacuum problem was in some other area.

The third shipment of coal water fuel arrived at site early this morning. Unloading was delayed until the turbine problem surfaced.

At approximately 11:20 a.m. a baghouse test was conducted with No. 1 unit fans on.

The following measurements were recorded:

BAGHOUSE ONE COMPARTMENT ONLY IN SERVICE

Location: Compartment #1 nearest roadway
Compartment #2 middle one
Compartment #3 nearest river

	COMPT #1	COMPT #2	COMPT #3
Readings From Discharge Ducts on Fan Side of Discharge Dampers	1.7" WG	0.87"WG	1.8" WG
	1.7" WG	1.1" WG	1.9" WG
	1.6" WG	1.1" WG	1.8" WG
	1.6" WG	1.3" WG	1.7" WG
	1.7" WG	1.3" WG	1.7" WG
	1.7" WG	1.3" WG	1.6" WG
Avg. Vel. Head Press.	1.67"WG	1.16"WG	1.75"WG
P (Across Bags)	2.0" WG	0.8" WG	2.0" WG

Static Pressure on Fan Inlet - 6.8" WG
Air Temp - 110°C

BAGHOUSE ALL COMPARTMENTS IN SERVICE

	COMPT #1	COMPT #2	COMPT #3
Readings From Discharge Ducts on Fan Side of Discharge Dampers	0.9" WG	0.65"WG	0.80"WG
	1.1" WG	0.72"WG	0.80"WG
	1.1" WG	0.81"WG	0.79"WG
	1.0" WG	0.90"WG	0.75"WG
	1.1" WG	0.93"WG	0.72"WG
	1.2" WG	0.85"WG	0.72"WG
Avg. Vel. Head Press.	1.07"WG	0.81"WG	0.76"WG
P (Across Bags)	1.5" WG	0.45"WG	1.4" WG

At approximately 6:30 p.m. the turbine was ready to receive steam. The vacuum problem was still there and for approximately one hour the operations people made every effort to find the source of the problem.

At approximately 7:30 p.m. NRC placed the CWF gun in burner No. 2 so as to minimize the consumption of the heavy oil while the operations staff continued searching for the source of the vacuum problem.

Problems were experienced with the CWF gun in service in that its high heat output resulted in the reducing of the heavy oil pressure to 40 psig in order to prevent the steam drum safety valves from staying open (No steam to turbine). The result was high opacity and an unstable condition so both guns were taken out of service.

At approximately 10:30 p.m. a discovery of a leak in the pipe loop on the intermediate steam air ejector was made. At this point it was felt that this was the reason for the vacuum problem. The pipe was removed and was to be replaced and the boiler was to be fired up at 5:30 a.m. tomorrow morning.

February 21, 1986

The operations people were ready to put steam to the turbine at approximately 7:30 a.m. Again, vacuum problems still exist. The boiler was kept ready while further checks were made for leaks around the turbine and condensor.

At approximately 10:30 a.m. the boiler guns were taken out of service.

The plan at this point was to conduct another check on all areas for possible air leakage.

At approximately noon a hole was found in the expansion joint on the atmospheric vent. It was the general consensus that this would not cause the sort of problem that was being experienced, however, the maintenance staff repaired the expansion joint.

Up to this time the strainer baskets had been checked on the water side and were clean, a water seal was manually established in the replacement loop on the intermediate steam air ejector and it was felt that the problem had to be with the first steam air injection loop.

In order to check this area a good portion of the remaining day would be required. With the consideration of the operations personnel available, and the uncertainty of the turbine availability, it was agreed to send the efficiency people home.

Work would proceed relative to seeking out the turbine problem and relative to the burner modification work by Dr. Kelly Thambimuthu over the weekend.

Contact would be made between N.B. Power head office and the plant on the progress of the solution to the turbine problem and a direction on the course of the program would be made Monday, February 24, 1986.

Kenneth C. Brown

Kenneth C. Brown

File: CWF.4
- Chatham Baghouse Test
- NRC Burner Test
Date: 27 Feb. 86

Report on Visit to the
Chatham T. G. Station

Date of visit: 24 to 26 February, 1986

Reason for visit: Testing of NRC/EMR burners and new baghouse

Details of visit:

Review of the First Week of Testing (18 to 21 Feb. 86)

First thing Monday morning (Feb. 24/86) I went into Head Office so that I could obtain a report from Ken Brown on what had been achieved at the Chatham Plant the week of February 18 to 21-1986 (I had been unable to go to Chatham myself because of illness).

Basically no testing had been done because on Tuesday (Feb. 18/86) the operators could not put the unit into service because of a problem with a feed water valve. On Wednesday (Feb. 19/86) after the valve had been repaired, the unit was in service for a short time but had to be shut down again because of a loss of vacuum in the turbine condenser, and the turbine started to overheat.

It was late Friday evening (Feb. 21/86) before the problem with the condenser vacuum was corrected and the unit put back into service. By this time the test crew had returned to Fredericton because it was too late that week to undertake a test program. The NRC crew ran two of their large guns for a few hours on Friday evening to try and obtain the settings which would give the best performance for their guns - when burning the new coal water reel (CWF).

Some air flow tests of the baghouse had been conducted and the bags had been coated with lime.

No burner testing was carried out over the weekend but on Sunday a new sleeve was installed in the throat of the number one burner.

Monday, Feb. 24 - 1986

Once the unit No. 1 boiler was in service on Monday morning (Feb. 24/86) a NRC gun was tested in the modified No. 1 burner. By the time I arrived at the Chatham plant, they had the following burners in service:

burner No. 1 - NRC gun burning CWF in the modified No. 1 burner throat

burner No. 2 - heavy oil with Forney gun

burner No. 3 - heavy oil with Forney gun

burner No. 4 - NRC gun burning CWF

The operators were having a problem maintaining the required atomizing air pressure to the NRC guns and felt the low pressure was being caused by a problem with the air compressor. They requested permission to obtain a second compressor to try and overcome the problem. The Chatham plant stores were requested to have another compressor delivered right away.

The second compressor was on site by 4 pm but the wrong hose fittings had been sent, and it was 5 pm before the compressor was in service and the required atomizing air pressure obtained.

Not all the afternoon was lost, as the 125 CFM in plant compressor was used for a short time, until it started to overheat.

Once two CWF guns were in service without any support firing from either the light oil ignitors or heavy fuel oil guns, it was decided to put the baghouse in service. Unfortunately, the motor could not be started because the plant electrician had been working on the electrical breakers and had left the one which feeds to the baghouse motor in the open position.

By 6:30 pm the opacity had gone to 60% reading (not corrected for the unit No. 2 fans) so an oil gun had to be put back into service.

The following readings were taken at the unit No. 1 burner front.

Burner No. 1 - CWF - 85 psig
Atomizing Air - 115 psig

Burner No. 2 - CWF - Not in Service
Atomizing Air - Not in Service

Burner No. 3 - Heavy Oil - 65 psig
Atomizing Air - 102 psig

Burner No. 4 - CWF - 65 psig
Atomizing Air - 112 psig

Opacity reading 38% (not corrected for No. 2 fans)

At 6:45 pm the oil gun was taken out of service and the opacity reading went up to 48%.

The baghouse was put into service and the opacity reading dropped over 10%. The baghouse was kept in service for approximately half an hour, and the pressure drop across the baghouses increased 1/2" water gauge (WG). The baghouse was in service again from 7:45 pm to 8:05 and again the opacity reading dropped 10%.

During both of the baghouse tests, the boiler operators were experiencing problems maintaining stable CWF fire without any support oil guns in service. (The baghouse had nothing to do with this.)

At 8:15 pm the unit was shutdown for the day and a meeting was held in Don MacDonald's office to review the day's work. The following people were present:

Don MacDonald - NB Power Chatham
Keith Keoughan - NB Power Chatham
Kelly Thambimutha - EMR Canmet
Adain Bennett - NRC
Floyd Toll - NRC
Hedley Smith - MBB Halifax
Mike Thanisch - NB Power Fredericton

NRC people reported they felt they had obtained fires as good as possible with the new coal water fuel, but the fires were not as good as the ones obtained in the fall of 1985. They felt they should be able to repeat the same firing the next day.

Kelly Thambimuthu reported he was pleased with the improvements that had been obtained with the fire in the No. 1 burner after the throat modifications had been made.

It was generally agreed the Efficiency group should return to the Chatham Plant the following day to undertake this test program.

Phone calls were made to both Dave Rankin and Wayne Davies in Fredericton to arrange for the test to be conducted the next day.

There were two reasons to conduct the test as soon as possible:

1) The new fuel was degenerating, the viscosity was dropping while the moisture level was constant.

2) The unit No. 1 boiler would not be available after Thursday (Feb. 27/86) for a minimum of four days because a hydro test was being conducted on the Unit No. 3 boiler, and no water would be available for Unit No. 1 boiler.

Tuesday Feb. 25, 1986

Everyone was at the plant by 8 am and at 8:15 am Dave Rankin was called again to ensure the test group would return to the Chatham Plant that day to undertake the efficiency tests of the unit No. 1 boiler. The tests would be conducted while burning the new coal water fuel, with the two large NRC guns in operation with both atomizing air and steam. A third efficiency test with the two NRC guns burning heavy oil would be conducted.

Later we were told two people from the test group would be in Chatham after lunch to conduct a shortened efficiency test on the unit No. 1 boiler.

All morning was spent trying to obtain at least the same level of combustion that had been obtained the day before with the new fuel and the NRC guns. The viscosity of the fuel had dropped further overnight; even though it had only been recirculated for an hour on the night shift; to ensure the fuel lines did not become plugged with settled CWF.

8:45 am - Hedley Smith and I inspected the filter bags in all three baghouses and it was noted a good cake, about 1/4" thick (0.6 cm) had built up on all the bags.

10:36 am - Bughouse was put in service, and the pressure drop across each baghouse was recorded throughout the day.

11:26 am - The light oil ignitor was removed from the No. 1 burner which had the NRC gun in it burning C.W.F. The opacity reading was 25%.

12:24 pm - The second NRC gun with CWF was put in service in the No. 4 burner.
- The flame was unstable.

12:30 pm - The NRC gun in burner No. 4 was removed.

12:36 pm - More adjustement made to burner No. 1.
- The opacity reading was 18%.

12:38 pm - No. 4 burner back in service with CWF and a light oil ignitor.

1:04 pm - Ignitor removed from burner No. 4
- The fire is quite good
- Opacity reading 29%

1:07 pm - The ignitor had to be put back in burner No. 4.

Note - The two people from the efficiency group arrived at lunch time at the Chatham plant.

1:40 pm - burner No. 1 - CWF
- burner No. 2 - heavy oil
- burner No. 3 - not in service
- burner No. 4 - CWF with a light oil ignitor

1:50 pm - CWF fires became unstable
- Two heavy oil guns put in service.
- Min. load on the unit.
- Problem with the CWF check valve

3:00 pm - CWF system back in service.

3:06 pm - No. 1 burner back in service with CWF with a light oil ignitor.
- Opacity reading 10%.

3:10 pm
- Burner No. 4 back in service with a light oil ignitor
- opacity reading 18%

4:05 pm
- CWF gun removed from burner No. 1 because of a larger number of sparklers (fire flies) in the furnace.
- It was found part of the No. 1 atomizer tip had been lost.
- This was a thin wall tip that was being tested.
- The atomizer tip was replaced.
- CWF guns back in service.

5:00 pm The first efficiency test was started:
- Two CWF guns with air atomization
- Burner No. 1 - CWF
- Burner No. 2 - not in service
- Burner No. 3 - not in service
- Burner No. 4 - CWF with an ignitor

6:00 pm
- First test completed
- Burner No. 1 switched to steam atomization
- Problem obtaining the required steam pressure at the gun
- The auxiliary steam header pressure was increased to 140 psig
- The pressure at the gun did not increase, it was felt there was too much steam flow through the NRC gun
- The steam passage was partly closed
- It should be noted this was the first time the new large NRC guns had been used with steam atomization
- Finally the No. 1 burner was in service with CWF and steam atomization
- Many attempts were made to obtain stable fires in the No. 4 burner but acceptable fires could not be obtained

7 to 7:30 pm
- Short/part test on Steam/air atomization
- Test with CWF
- Burner No. 1 - CWF with steam atomization
- Burner No. 2 - not in service
- Burner No. 3 - not in service
- Burner No. 4 - CWF with air atomization and a light oil ignitor

7:30 pm
- Steam Atomization Test halted

7:40 pm
- No. 1 burner switched back to air atomization

7:45 pm
- Baghouse cleaned with the pulse jets while the fan was running
- No. 1 Baghouse took some time to drop from 6.6"WG to 3."WG
- No. 2 Baghouse also took some time to drop from 5.4"WG to 2.5"WG
- No. 3 Baghouse dropped very quickly from 6.3"WG to 2."WG

NOTE - When the fly ash was dumped from the baghouse hoppers down into the drums, the drums overfilled making quite a mess in the fan floor area.

8:00 pm
- Started to switch the two NRC guns over to Heavy oil firing
- Burner No. 1 brought into service with heavy oil and the ignitor was removed
- The flame seemed quite good for a while and then very quickly the flame was lost and the ignitor was put back in Burner No. 1
- No. 4 burner put in service with heavy oil

8:25 pm
- Both light oil ignitors were removed.

8:30 to 9:00 pm

- some adjustments were made to burner No. 4 to pull the flame back to attach it to the burner (gun)
- Unit No. 2 boiler fans shutdown
- Opacity reading 6%

9:30 pm
- The third NRC gun/atomizer test start while burning heavy oil with steam atomization
- Steam for 50,000 lbs/hour

10:00 pm
- Heavy oil test completed

10:10 pm
- Unit No. 1 shutdown
- there was only about 10 tons of CWF left in the barker

Wednesday - Feb. 26/86

The baghouse could not be opened to inspect the bags because there was a very heavy snow fall, and it was felt the fly-ash cake on the bags would get wet if it was exposed to the snow.

Monday - March 3/86

The bags were inspected while conducting a tour of the plant and new baghouse for Dr. Phil Roall of EMR, and Dr. Horace Whaley of EMR CANMET.

- The bags in the No. 1 Baghouse still had quite some larger buildups of fly-ash in places on them. They had been cleaned with the pulse jets air supply set at 55 psig.

- The bags in the No. 2 Baghouse were quite clean. They had been cleaned with the pulse jets air supply set at 100 psig.

- The bags in the No. 3 Baghouse also had quite a buildup on them in places. They had been cleaned with the pulse sets air supply set at 100 psig.

NOTE-Further testing of the NRC guns and the baghouse could not be under taken until both more CWF had been received from CBDC in Sydney NS, and the Hydro tests had been completed on the Unit No. 3 boiler.

Pump Test

- An air operated diaphragm pump was tested, for handling coal water fuel while it was being unloaded from the delivery trucks.

  This pump did not work well and would not pump the CWF up into the Chatham in-plant storage bunker while working on its own. For this reason it was only used to supply CWF the transfer pump located in the Chatham Plant Basement.

  It was felt the problem with the pump was caused by the air discharge port on the pump freezing up.

Prepared by

M.R. Thanisch

M. R. Thanisch

File: CWF-5 NRC Gun Test
Baghouse Test

1986-03-10

VISIT TO THE CHATHAM PLANT

DATE: Wednesday, March 5 to Saturday, March 8, 1986

REASON: Testing of the Modified NRC Gun and Burner, and Testing of the Baghouse.

DETAILS OF VISIT:

Wednesday, March 5

- I arrived at the Chatham Plant at 10:15 a.m. Kelly Thambimuthu of EMR had arrived on Tuesday and had the larger sleeve installed in the No.1 burner throat.
- Hedley Smith arrived from Halifax about 9:30 a.m. While the No. 1 unit was being brought on line, a leak developed in the boiler feed pump packing and the unit had to be shutdown to correct the problem.
- Hedley, Kelly and I inspected the baghouse and took some pictures of the bags.

    1. 3 pictures of the fiberglass bags.
    2. couple of the polyester bags.
    3. couple of the nomex (white spot) bags.

- Some pictures were also taken of baghouse. The baghouse door were closed and the pulse jet cleaning system put in service, after about ten minutes the baghouse were opened and the bags inspected again. This time, all the bags were free of any build-up and the fiberglass bags still had some lime on them (the bags are black) but as the other two (2) sets of bags are white so it was impossible to tell if there was any lime left on them.
- At 11:45 a.m., the operators started to put the unit into service, as the boiler feed pump packing had been replaced.

12:20 p.m. - Call from Dave Lawrence on operating the Baghouse

1. Clean the bags when the pressure (PD) builds-up to 4" to 5"
2. Continue cleaning the bags until the pressure drop goes down to 2" to 3"

3. Let PD build up to 4" to 5" again before cleaning
4. Clean fiberglass off line.
5. Long term blinding, PD will continue to increase and not drop back after cleaning.
6. Pulse the bags for ½ hour with clean dry air before long term shutdown.
7. Nomex may be subject long term acid attack - remove and clean before long term shutdown.
8. Pulge 50 to 75 millisec., with 7 to 10 seconds between pulses, when cleaning while the baghouse is in service; off line cleaning change to 5 seconds between cleaning.

1:30 p.m.

- The boiler was up to temperature and pressure and the operators started to roll the Unit No.1 turbine.

2:00 p.m.

- Turbine up to speed and unit on line. No.1 and No.3 guns in service on heavy fuel oil.

2:10 p.m.

- Adam Bennett and Floyd Toll of NRC in Ottawa arrived.
- There was no chart paper in the opacity meter. It has been on order for some time but it had not arrived.
- Some Foxborough paper that was the same width was used. The only problem was the sproke holes were on a different pitch.

2:20 p.m.

- No.1 oil gun switched to burner No.2 so that an NRC gun could be installed in the modified burner No.1.

2:35 p.m.

- 3 bags of lime (150 lbs.) were added to baghouse. The 'PD' came up to:
    1. 0.55" WG
    2. 0.3" WG
    3. 0.6" WG

- This was done with the inlet damper closed (just leakage) and air through 3" pipe nipple where lime was added.

3:05 p.m.

- Burners in-service
  Burner No.1 - ignitor only
  Burner No.2 - heavy fuel oil (HO)
  Burner No.3 - heavy fuel oil (HO)
  Burner No.4 - No gun ready for CWF

- Held up waiting for air supply to the NRC station, at No.4 burner.

- opacity reading 3%

3:10 p.m.

- Operator ready to put an NRC/CWF gun in burner No.1.
- Unit No.2 boiler fan put in service to dilute the flue gas from No. 1 boiler.

- Burners in-service

Burner No.2	H. Oil - 58 psig A.Steam - 60 psig
Burner No.3	H. Oil - 75 psig A.Steam - 75 psig

3:15 p.m.

- Burner CWF check valve plugged, so the NRC gun cannot be put in service.
- The NRC gun had to be steam cleaned because they had some heavy oil deposits still in them from last week's test program.

3:25 p.m.

- The CWF pump has been shutdown so the plugged check valve can be cleaned.

3:30 p.m.

- CWF system back in service, and ready to put the NRC gun in No. 1 burner with coal water fual (CWF).

3:40 p.m.

- Unit shut down because of a salt leak into the turbine condenser.

4-5:00 p.m.

- I took a visitor from the Iron Ore Company of Canada, Tom Martinovic for a tour of the Unit No.3 fluidized bed boiler project. The two chaps from NRC in Ottawa came along.

Overnight

- The maintenance crew will work the night shift to find and repair the condenser leaks.

Thursday, March 6

- The condenser leak was repaired overnight.

4:45 a.m.

- The operations started to steam the boiler.

7:00 a.m.

- When the operators tried to come on line with the No. 1 Unit, it was found some of the boiler feed pump control lines had frozen.

- The Unit No.3 construction crew had left the temporary access door to the basement open allowing cold air in, which froze the line.

8:00 a.m.

- I arrived at the plant and after being told of the problem, I visited the maintenance and construction crews to ensure the problem was being corrected.

9:00 a.m.

- The unit operators started to steam up the unit No.1 boiler again.
- All 4 ignitors in service.

9:15 a.m.

- H.Oil gun in service in burner No.1.

9:30 a.m.

- H.Oil gun in service in burner No.2.
- H.Oil gun in burner No.1 switched to burner No.3.

10:30 a.m.

- Started roll turbine.

11:00 a.m.

- Turbine coming up to speed.
- 3 HO guns in service.

11:05 a.m.

- Unit No. 1 on line.

11:25 a.m.

- No.1 burner in service, with the CWF and atomizing air (A. Air) supplied from the NRC manifold.
- Opacity reading 30%.

11:27 a.m.

- Ignitor removed from the No.1 CWF burner.
- Opacity reading dropped to 25%.

11:35 a.m.

- Baghouse in service.
- Baghouse test resdings - pressure drop (PD)

	11:35 a.m.	12:25 p.m.	1:45 p.m.	After Cleaning	Number Air Cycles
Baghouse 1 -	2.4" WG	4.0"	4.9"	3.7"	3 full
Baghouse 2 -	1.1" WG	2.6"	3.4"	1.2	1 full
Baghouse 3 -	1.3" WG	3.4"	4.3"	2.0	2 full

- Opacity Reading - 15% (at 11:35 a.m.)

12:00 noon

- Opacity reading jumped up to 30%. Secondary air (windbox) pressure decreased and the opacity reading came down 20%.
- Steam Flow 25,000 lbs/hr.

12:10 p.m.

- Burner No.4 ignitor in service.
- All lines have been checked and cleaned.
- NRC gun moved into position.
- Opacity reading 15%.

12:15 p.m.

- NRC gun in service in No.4 burner with a light oil ignitor.
- Opacity reading 24%.
- Burner front flows and pressures readings

Burner No.1 CWF	90 psi	A.Air 80 psi - Air flow 140 CFM
Burner No.2 H.Oil	57 psi	A.Steam 68 psi
Burner No.3 H.Oil	60 psi	A.Steam 80 psi
Burner No.4 CWF	60 psi	A.Air 85 psi

12:25 p.m.

- Baghouse "PD' taken (see table).
- Opacity reading 20%.

12:30 p.m.

- Opacity reading 25%.
- Adjustments made to the NRC gun in burner No. 1.

NOTE:
- This morning, the No.1 burner has the new large sleeve in the burner throat.
- The flame is smaller and quite ragged.
- Unburnt fuel is building up on the throat.
- Kelly is having to relearn how to shape the CWF flame with the large throat.

12:35 p.m.

- The ignitor was put back in the No.1 burner to try and remove the build-up.
- Opacity reading 28%.

2:15 p.m.

- The amount of fly ash in the drums was checked:

From Baghouse No.1 - 2/3 full
From Baghouse No.2 - 1/6 full
From Baghouse No.3 - 1/3 full

2:30 p.m.

- Burner front flows and pressures.
  No ignitors in service.

Burner No.1 - CWF 90 psi A.Air = 102 psig - Air flow =
Burner No.2 - H.Oil 63 psig A.Steam = 74 psig 140 CFM
Burner No.3 - Not in service
Burner No.4 - CWF 60 psig A.Air = 90 psig

- Opacity reading 27%.

- Opacity went up about 3% when the No.3 oil gun was removed.

- Load on unit before the oil gun was removed 100,000 lbs/hr.

- Load on unit after the oil gun was removed 85,000 lb/hr.

2:40 p.m.

- Increased the speed of the air compressor to maximum.
- Burner - No.1 CWF 95 psig A.Air 116 psig Air Flow - CFM
- Atomizing air pressure lost.

2:46 p.m.

- Opacity reading 30%.
- Air pressure back-up to pressure.
  Burner front flows and pressures readings

Burner No.1 CWF-81 psig	A.Air 100 psi	Air Flow = 140 CFM
Burner No.2 Oil-73 psig	A.Steam 104 psi	
Burner No.3 Not in service		
Burner No.4 CWF-90 psig	A.Air 120 psi	

Baghouse Test PD Readings

	3:40 p.m.	4:00 p.m.	4:22 p.m.	4:30 p.m. After Cleaning
Baghouse No. 1	- 14.9"	5.1"	5.1"	3.0" - Three full cycles
Baghouse No. 2	- 2.4"	2.8"	2.9"	1.0" - One full cycle
Baghouse No. 3	- 4.25"	4.4"	4.5"	4.9" - Five full cycles

3:45 p.m.

Velocity Pressures in the Three 16"Ø Discharge Ducts from Baghouse

Traverse Points Across Duct	No.1 Duct	No.2 Duct	No.3 Duct
1"	0.36	0.47	0.30
2"	0.40	0.49	0.40
3"	0.45	0.51	0.45
4"	0.45	0.55	0.48
5"	0.46	0.66	0.50
6"	0.45	0.68	0.50
7"	0.45	0.69	0.49
8"	0.44	0.71	0.47
9"	0.425	0.72	0.45
10"	0.42	0.72	0.45
11"	0.425	0.71	0.44
12"	0.415	0.66	0.44
13"	0.41	0.62	0.43
14"	0.4	0.59	0.42
15"	0.36	0.50	0.40
16"	0.29	0.40	0.30

All readings in inches water gauge

Gas Temperatures and Velocities

Discharge Duct From Baghouse	Temperatures		Velocity (Approximately)
No.1	149°C	300°F	3100 fpm
No.2	149°C	300°F	4050 fpm
No.3	149°C	300°F	3350 fpm

Static Pressures

Inlet Header to Baghouse Before Cleaning Bags = 1.3"WG
Inlet Header to Baghouse After Cleaning Bags = 1.7"WG

Inlet Duct to Fan Before Cleaning Baghouse = 8.6" WG
Inlet Duct to Fan After Cleaning Baghouse = 7.9" WG

4:47 p.m. - Pressure Drop Across Baghouse

Baghouse No. 1-3.8" WG
Baghouse No. 2-1.4" WG
Baghouse No. 3-2.7" WG

5:25 p.m. - Velocity Pressures in the Main Boiler No. 1 Breeching

Wall = 0.06" WG
12" = 0.1" WG
24" = 0.1" WG
36" = 0.11" WG
48" = 0.11" WG

Size of Breeching 5' x 7' - 6 (60" x 90")

Velocity Pressures in the Three 16"0 Discharge Ducts After Cleaning Bags

Traverse Points Across 16"0 Ducts	No.1	No.2	No.3
1"	0.39	0.36	0.55
2"	0.50	0.40	0.65
3"	0.57	0.46	0.71
4"	0.60	0.55	0.73
5"	0.61	0.59	0.74
6"	0.61	0.65	0.74
7"	0.59	0.70	0.72
8"	0.58	0.75	0.70
9"	0.575	0.77	0.67
10"	0.565	0.80	0.67
11"	0.55	0.79	0.66
12"	0.55	0.77	0.655
13"	0.55	0.76	0.65
14"	0.56	0.74	0.63
15"	0.53	0.65	0.58
16"	0.40	0.57	0.50
Gas Temperatures	151°C	151°C	151°C

All reading in inches Water Gauge ("WG)

Static Pressures

Inlet Header to Baghouse = 1.6" to 1.8" WG
Inlet Duct to Fan = 8.1" WG

5:00 p.m. - Fly Ash in Drums: (The drums had been emptied after the 2:30 p.m. bag cleaning)

From No. 1 Baghouse 1/3 full
From No. 2 Baghouse 1/6 full
From No. 3 Baghouse just enough to cover the bottom of the drum

5:40 p.m.- Static Pressures

- Inlet Header to baghouse - 1.7" WG
- Inlet Duct to fan 8.45" WG

5:55 p.m.

- CWF in Burners No.1 and No.4 with no ignitors.
- Ignitor put in burner No.2 and the oil gun removed.
- Opacity reading - 35%.

6:05 p.m.

- Both CWF guns firing at 42×10^6 BTU.
- No.1 clean and bright.
- No.4 bright but some fire flyes.
- Both guns have bushy fires.
- Steam flow 85,000 Lb/hour.

6:10 p.m.

Inspection of Ash Pit

- There is a small amount of very fine fall out and, now and again a small burning lump of fuel is coming down.
- There is a light cover of dust on the bottom of the furnace floor - but one can still see the shape of the water tubes.
- There is a small pile of burning ash/fuel below the burners.

NOTE:
- Kelly said he felt the smaller sleeve he used in the burner throat last week worked the better than the large one now in No. 1 Burner.

6:15 p.m. (5:15 p.m. in Ottawa)

- I tried to return Bill Pearson's call but there was no answer.

6:20 p.m.

- Load on unit - 6.2 MW
- Steam Flow 85,000 lb/hr.

6:45 p.m.

- No.1 CWF gun removed because fire unstable.
- The gun had been in service since 11:25 a.m. 7 hours, 20 minutes.
- Oil gun in service load on unit dropped 3 MW (+ tank heaters).
- The load had been 6.2 MW with two CWF guns + one ignitor.

7:02 p.m.

Static Pressures

- Inlet Duct to fan 8.9".
- Inlet Header to baghouse 1.5".

Pressure Drop Across Baghouse

Baghouse No. 1	5.4"	3.0" After cleaning with 4 cycles
Baghouse No. 2	2.8"	1.0" After cleaning with 1 cycle
Baghouse No. 3	4.7"	2.0" After cleaning with 2 cycles

Checked fly ash drums:

From No. 1 Baghouse - little change since 4:30 p.m.
From No. 2 Baghouse - 3" deep in bottom of drum
From NO. 3 Baghouse - too much dust to see what is in the drum

7:08 p.m.

- No.1 CWF gun back in service.
- Small pieces of rubber were found in the No.1 CWF gun atomizer tip.
- These were removed and the gun returned to service.

7:30 p.m.

Fan motor current - 25.7 Amp
Power = Volts x Amps
575 x 25.7 = 14.78 Kw = 19.8 HP

7:40 p.m. - Burner front flow and pressure readings

Opacity reading - 30%.

Burner No.1 - CWF 110 psig	A.Air 105 psig	Flow 135 cfm
Burner No.2 - Oil 65 psig	Steam 90 psig	
Burner No.3 - Not in Service		
Burner No.4 - CWF 89 psig	A.Air 110 psig	

7:48 p.m.

- Ignitor put in No.1 burner.
- Atomization changed to steam from air.
- Opacity jumped because of loss of steam to the oil gun.
- This was corrected and the opacity dropped back 35%.

- No.1 ignitor removed.
- Burner front flows and pressures readings

Burner No.1 - CSF 78 psig	A.Steam 85 psig, Temp.155°C, 310°F
Burner No.2 - Oil 57 psig	A.Steam 82 psig
Burner No.3 - Not in Service	
Burner No.4 - CWF 80 psig	A.Air 120 psig

- Opacity reading dropped back to 30% when the ignitor was removed.
- Kelly thinks the flame looks a little more ragged with steam atomization but the flame is still very bright.

8:00 p.m.

- There is still a very fine and slow build-up of ash in the bottom of the furnace but there is no burning.

8:05 p.m.

- No.1 burner fire clean and bright - no sparkers.
- No.4 also looks good with A.Air.
- Opacity reading 32%.
- Load on unit - 6.0 MW.
- Steam pressure - 600 psig.
- Steam temperature - 750°F.

Bunker Outage	2:20 p.m.	17' - 10"	- 14,000 im gallons (imp)
	4:30 p.m.	18' - 9 1/2"	- 12,250 im gallons (imp)
	7:35 p.m.	20' - 1 3/4'	- 10,100 im gallons (imp)
	9:20 p.m.	21' - 1 1/2"	- 8,600 im gallons (imp)

8:25 p.m.

- Lost atomizing air flow to No.4 gun - No.4 gun removed.

8:35 p.m.

- The air compressor was overloading and shutting down. The operator opened a bleed valve and No.4 gun was returned to service.

9:00 p.m. Baghouse Test

Baghouse PD's:

Baghouse No. 1	5.4 down to 3" in three minutes with pulse jets in service cleaning bags.
Baghouse No. 2	2.5 down to 1" in one minute with pulse jets in service cleaning bags.
Baghouse No. 3	4.6 down to 2" in two minutes with pulse jets in cleagning bags

9:15 p.m.

- Oil gun put in No.3 burner.

9:20 p.m.

- Bunker 21-1½" - 8,600 gallong (imp)
- Since 7:35 p.m. (1 hour - 45 minutes), 1500 gallons have been burnt. This is equal to 857 gph.

9:42 p.m.

- Opacity 30%.
- Load on unit - 5 MW.
- Steam Flow 90,000 lb/hr.

9:55 p.m. - Burner Front Flow and Pressure Readings

No.1 CWF 88 psig	A.Steam 110 psig, Temp.330°F
No.2 Not in Service	
No.3 Oil 60 psig	A.Steam 96 psig
No.4 CWF 85 psig	A.Air 105 psig

- Opacity reading 32%.
- Load on unit - 5.5 MW.
- Steam Flow 98,000 lb/hr.

10:10 p.m. Baghouse Test

Baghouse No. 1	4.9" - after cleaning 3.4"	cleaned at 10:22 p.m.
Baghouse No. 2	2.0" - not cleaned	
Baghouse No. 3	4.5" - after cleaning at 3.3"	

10:30 p.m.

- Checked fly ash drums.

From No.1 Baghouse - 2/3 full
From No.2 Baghouse - 1/3 full (bag not cleaned)
From No.3 Baghouse - over 2/3 full plus a large amount on floor from leakage from top of slide knife gate valve (the ash must have been hanging up in the hopper)

10:35 p.m.

- No.4 CWF gun switched to atomizing steam but the opacity went up so it was switched back to atomizing air.

10:43 p.m.

- No.2 gun removed. No.2 gun had been used to maintain an atomizing air flow.

10:50 p.m.

- Bunker 21'-11½" outage = 7,500 imp.gallons.

11:15 p.m.

- Pressure drops across baghouse:

Baghouse No.1	4.8" WG
Baghouse No.2	2.6" WG
Baghouse No.3	3.8" WG

- Pulse jets put in service on No.1 and No.3 for a few minutes.

11:22 p.m.

- Burner No.1 has developed a number of "fire flies". The flame is so big and bright it is hard to see the burner throat to see if there is a build-up.
- The windbox pressure reduced to 1.3 from 1.5.

11:25 p.m.

- Opacity reading - 78%. (This was just a short swing)
- No.1 fire has improved.
- It could have been a fuel problem.

11:28 p.m.

- Opacity reading - 17%

11:30 p.m. - Burner Front Flow and Pressures Readings

Burner No.1	CWF 75 psig	A.Steam 95 psig	Temp.320°F
Burner No.2	Oil 75 psig	A.Steam 95 psig	
Burner No.3	Oil 55 psig	A.Steam 100 psig	
Burner No.4	not in service		
Steam Flow	85,000 Lbs/hour		

12:00 Midnight

- No.1 gun with CWF will be left in service at 43 x 10^6 BTU all night with two oil guns at light load to keep the heat up in the boiler.
- The baghouse will also be left in service.

Friday, March 7

7:30 a.m.

- No. 1 Burner in service all night (with no ignitor) and steam atomization.

- This Burner has been in service for 12 hours with steam atomization, plus 8 hours on air atomization for a total of 20 hours continuous service.
- The opacity reading was steady all night at 28%.
- The steam flow was held at 75,000 Lb/hour at night.

8:15 a.m.

- No.4 gun in service with CWF with a light oil ignitor.

8:30 a.m.

- No.4 ignitor removed.
- Opacity reading - 40%.

8:40 a.m.

- Current to baghouse fan motor = 25.4 Amps.

9:17 a.m.

- No.3 H.Oil gun removed.

9:45 a.m. - Steam Flow 100,000 lb/hr.

10:00 a.m.

- Bunker 27'-3¼" outage = 15 tons approximately.

NOTE: This morning I took a number of pictures of the burner No.1 fire. Some from the back of the boiler and some from the ash pit door.

10:30 a.m. Baghouse Test

Inlet Duct to Fan	Sets of Readings		
Test Points	1st	2nd	3rd
Wall	0.85	0.75	0.85
4"	0.87	0.72	0.85
8"	0.75	0.50	0.70
12"	0.50	0.30	0.47
16"	0.30	0.29	0.25
20"	0.23	0.33	0.24
24"	0.35	0.37	0.30
Far Wall	0.35	-	0.57

Inlet Header to Baghouse

Test Points			
Wall	0.02	0.50	-
6"	0.60	0.10	0.01
12"	0.15	0.20	0.03
18"	0.30	0.35	0.35
24"	0.35	0.45	0.52
30"	0.25	-	0.35

All reading in inches of water gauge.

11:05 a.m. Main Breeching

	Traverse	
	1st	2nd
Wall	0.05	0.05
12"	0.08	0.09
24"	0.09	0.10
36"	0.095	0.10
48"	0.10	

11:15 a.m. - Static Pressure in Breeching - 0.50" WG
- 0.55" WG

11:20 a.m. Static Pressures

Centre baghouse damper closed.

Inlet header to baghouse - 0.8" WG
Inlet duct to fan - 9.0" WG

11:22 a.m. Pressure Drop Across Baghorses

Baghouse No. 1	6.2"
Baghouse No. 2	out of service
Baghouse NO. 3	5.6"

- Opacity jumped up then settled back to 30%.

Pulse Jet Timer switched on:

Baghouse No. 1 one cycle down to 5"
Baghouse No. 3 two cycles down to 3.5"
Baghouse No. 1 after 3 to 4 minutes to 4.6"
Baghouse No. 3 after 3 to 4 minutes to 3.2"

11:30 a.m.

Ash drum: (The drums were emptied overnight)

From No. 1 Baghouse - very little
From No. 3 Baghouse - over 2/3 full

11:45 a.m. - Burner front flows and pressures readings

Burner No.1 - CWF 73 psig	A.Steam 90 psig	Temp.of Steam 315°F
Burner No.2 - Oil 75 psig	A.Steam 80 psig	
Burner No.3 - not in serice		
Burner No.4 - CWF 80 psig	A.Air 110 psig	

- Opacity reading - 30%.
- Steam flow - 75,000 lb/hr.

11:50 a.m.

- Burner No.1 has now been in service for 24 hours without an interruption (Except to remove some small pieces of rubber) including 16 hours with atomizing steam. The fire still looks bright and stable with no fire flies.
- Burner No.4 in service with no ignitor and air atomization.

11:57 a.m.

- Lost No.4 CWG gun.
- No light oil pressure so an ignitor could not be put in.
- The pump had been shut down because it was not being used and when the operator went to start it, the prime had been lost.

NOTE: At 11:00 a.m., the bunker was gauged at 28'-10" appriximately 11 tons (1800 imp.gal).

12:05 noon

- Ignitor back in burner No.4.
- No.4 CWF gun back in service.
- Opacity - 45%.

12:20 p.m. Pressure Drops Across Baghouse

Baghouse No.1 - 6.2"	4.5" (after cleaning for 3 minutes)
Baghouse No.2 - not in service	
Baghouse No.3 - 5.7" alot in service	3.1" (after cleaning for 2 minutes)

12:25 p.m.

I tried to call Lloyd Tozer on PEI but he was not in because of the snow storm.

12:40 p.m. Baghouse Test

Static Pressured

Inlet header to baghouse - 0.8"
Inlet duct to fan - 8.6"

Pressure Drops Scross Baghouse

Baghouse No.1 - 5.4"
Baghouse No.2 - out of service
Baghouse No.3 - 4.9"

12:54 a.m. - No. 4 gun becoming unstable as the bunker is burnt down.

1:10 p.m.

- Unit No. 1 shutdown because all the CWF in the bunker had been burnt.

2:20 p.m.

- Baghouse inspected.
- No.2 (polyester) bags checked, these bags had failed.
- This had been shown by:

  1. - no increase in pressure drop (PD)
  2. - when the bags were purged with air, the PD dropped to 0.5" WG
  3. - pieces of the bags were found in the ash drum.

- The No. 2 baghouse had been taken out of service before the end of the test program. On inspection, the bag looked quite clean and there was no noticeable build-up on them. No pictures were taken.

- No.3 bags (Nomex) were checked and there was quite a build-up on the bags. The pulse jet cleaning was put in service and the bags cleaned quite well. The 'PD' could not be checked because the fan was not in service.

- The No. 1 bags (fiberglass) were checked and there was some build-up on the bags - not as much as the Nomex. This build-up would not fall off the bag as easily as the No.3 (Nomex) bags when they were manually banged. Three pictures were taken. The pulse jet cleaning was put in service but again, the deposits did not come off readily.

- The baghouse doors were closed.

2:45 p.m.

- The pulse jet cleaning had been in service for 25 minutes. The Nomex bag still had a thin film on them which could be brushed off by hand but the pulse jets would not remove it. The fiberglass looked clean. The baghouse fan was restarted to check the pressure drop across the bags.

  No.1 - 2.3"
  No.2 - out of service
  No.3 - 1.6"

- The fan was shut down.
- One of the polyester bags from baghouse No.2 was removed and the material was found to have become very soft with no strength.
- The hoppers were dumped. There was too much of cloud of ash on the fan floor to check the drums. After some time, the fly ash was everywhere, much worse than last week.

Saturday, March 8

8:30 a.m.

I went to the Chatham Plant to:

- Close the valves on the baghouse hoppers.
- To obtain samples of the bag which had failed.
- To get the chart from the opacity meter.
- The fly ash had settled around the collection drum on the fan floor but there was too much fly ash around to be able to check inside the drums.
- I will have operators check the drums on Monday before they are emptied.
- I left instructions with the operator on duty to leave the heaters on in the baghouse and to have the air diaphram pump shipped back to Sydney.
- As the sun was coming out, I took some pictures of the baghouse on the roof.
- I left the plant at 9:30 a.m.
- I was back to Head Office by 12:30 p.m. to return test equipment, etc.

Prepared by: ______________________

M. R. Thanisch

TIME	1:00am	2:00	3:00	4:00	5:00	6:00	7:00	~~8:00~~ 11:00	9:00	10:00	11:00	12 N	1:00	2:00	3:00
Steam Flow	75	75	75	75	75	75	75	73 →				83			
Air Flow	70	70	70	70	70	70	70	78				79			
~~SO2~~ opacity	22%	23%	22%	22%	24%	22%	21	32%	~~34%~~			31%			
Steam Temperature	742	740	742	742	742	742	742	795				795			
Drum Steam Pressure	600	600	600	600	600	600	600	600				600			
Steam Header Pressure	585	585	585	585	585	575	585	590				590			
Feed Water Temperature	250	250	255	280	250	250	250	250				240			
Feed Water Pressure	850	845	845	845	845	845	841	850				850			
F.D. Fan Discharge	3.1	3.0	3.0	3.0	3.1	3.1	3.1	3.2				3.2			
Sec. Air Press. @ A.H. Outlet	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.5				1.5			
No. 1 Exhauster Discharge Press.															
No. 2 Exhauster Discharge Press.															
No. 1 Burner Box	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4				1.4			
No. 2 Burner Box	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3				1.3			
No. 3 Burner Box	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4				1.4			
No. 4 Burner Box	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3				1.3			
No. 1 Pulverizer Diff.															
No. 1 Pulverizer Inlet Draft															
No. 2 Pulverizer Diff.															
No. 2 Pulverizer Inlet Draft															
Furnace Draft	-.04	-.04	-.04	-.04	-.04	-.04	-.04	-.05				-.05			
Boiler Uptake	-.58	-.6	-.6	-.6	-.6	-.6	-.6	-.7				-.6			
Dust Coll Outlet Draft	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7	-2				-2			
A.H. Outlet Draft	-3.9	-3.9	-4.0	-4.0	-4.1	-3.9	-4.0	-4.5				-4.5			
Air Temp. Entering Heater	100	100	100	100	100	100	100	100				100			
Gas Temp. Entering Air Heater	560	560	560	560	560	560	560	575				575			
Gas Temp. Leaving Air Heater	320	320	320	320	320	320	320	335				335			
Secondary Air Temp.	410	410	410	410	410	410	410	425				425			
Primary Air Temp.	410	410	410	410	410	410	410	425				425			
No. 1 Pulverizer Motor Amps															
No. 2 Pulverizer Motor Amps															
F.D. Fan Motor Amps	87	87	87	87	87	87	87	87				87			
I.D. Fan Motor Amps	100	100	100	100	100	100	104	105				105			
No. 1A Duct Coal & Air Temp.															
No. 1B Duct Coal & Air Temp.															
No. 2A Duct Coal & Air Temp.															
No. 2B Duct Coal & Air Temp.															
Air Manifold High Press.															
Air Manifold Low Press.															
Supply Air Press.	95	95	100	100	98	95	95	100				95			
F.W. Air Control Press.	11.5	11.5	11.0	11.5	11.5	11.5	11.1	10.5				11.5			
No. 1 Cap. Damper Air Control Press.															
No. 2 Cap. Damper Air Control Press.															
F.D. Air Control Press.	10.5	10.5	10.5	10.5	10.5	10.5	10.6	11				11			
I.D. Air Control Press.	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16				16.5			
Master Control Press.															
Boiler Damper Posn	Open	Open	Open	Open	Open	Open	Open	Open				Open			

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
INTERNAL CORRESPONDENCE

CHATHAM PLANT

March 10, 1986

PLEASE REFER TO OUR FILE NUMBER..............................

File: CWF Chatham
Coal/Water Burner Development
NRC Test [illegible]
Date: [illegible]

MEMO TO: DAVE RANKIN
H.O. 4B

SUBJECT: COAL-WATER BURNING

****

The following are general comments on coal-water as well as specific comments on the burning of March 6-7, 1986.

Some major developments during our coal-water testing:

1) The problem of excessive wear of the atomizer has been overcome.
2) An atomizer with ceramic parts, capable of withstanding a furnace environment is now available.
3) A National Research Council gun and atomizer is capable of being externally adjusted thereby allowing more tolerance to the fuels as well as being capable of burning coal-water or Bunker C.
4) A gun and atomizer capable of utilizing atomizing air or steam is available.
5) A Forney Engineering burner on our Foster Wheeler boiler has been modified with promising results. This burner is much more tolerant of changes in the fuel.

Observations of the March 6-7 coal-water burn lead me to make the following comments:

1. The #1 burner, modified under the direction of Dr. Kelly Thambimuthu, was obviously superior. Towards the end of testing the #4 burner, on coal-water, became unstable and had to be purged and re-lit. The #1 burner showed no loss of stability during 24 hours of continuous operation.

2. The #1 burner operated on coal-water from 13:00 hrs to 19:30 hrs utilizing air as the atomizing medium. From that point until March 7, at 13:00 hrs steam was used for atomization . This must be considered a major milestone.
3. The brightness, few fireflies and very little fall-out of #1 and #4 fires lead me to assume we had good atomization.

Due to the various results we have had during burning of coal-water, I can only assume the fuel has been the most detrimental to proper atomization.

I feel quite confident we now have a burner and atomizer capable of good atomization within a range of fuel specification. I cannot pinpoint the exact range in which we can operate efficiently. I can only assume the fuel manufacturers either do not know this range or are unable to meet it on a consistent basis.

Don MacDonald
Don MacDonald
Chatham Plant Manager

DM/dm

cc: M.Thanisch
C. Baird
R. Pickles
V.K. Clark

File: CWF-4
NRC Burner Test
Baghouse Test

Date: March 12, 1986

REPORT ON MEETING

FOR COAL WATER FUEL BURNER DEVELOPMENT

LOCATION: NRC's Office in Ottawa

DATE: March 12, 1986

TIME: 11:00 a.m. to 4:00 p.m.

SUBJECT: Review of the NRC gun/atomizer and the new No.1 Burner Tests and the Baghouse Test Programs between February 17, 1986 and March 7, 1986.

PEOPLE PRESENT AT MEETING:

Mike Thanisch - NB Power
Adam Bennett - NRC
W. Thayer - NRC
Ed Capes - NRC
Kelly Thambimuthn - EMR- CANMET
Dave Burnett - MBB-Halifax
Bill Pearson - EMR - Coal Division
Kevin Jonasson - NRC
Cliff Adams - EMR - CANMET
Horace Whaley - EMR CANMET/CCPL
Adrian White - CBDC
Phil Read - EMR Coal Policy

DETAILS OF MEETING:

1. Review of Tests - NRC's gun/atomizers - Modifications to Burner No.1 and Baghouse

A. 1st Week of Test Program (February 17 to 21, 1986)

- New sleeve installed in the No.1 burner throat and collars installed around the sleeve dampers on all four burners to improve control of the primary combustion air flow.
- On Wednesday, some burning to set-up the NRC gun/atomizers.
- Unit No.1 out of service Thursday & Friday to repair a vacuum leak in the condensor.
- Some burning until Friday evening.
- The opacity was 40% to 45% with an unsupport coal water flame and two large guns in-service.
- Air flow test of the baghouse.
- Lime coating of the bags in all three baghouses.

B. 2nd Week of Test Program (February 24 to 28, 1986)

- Efficiency testing of two NRC guns under the following conditions:
  1. Two NRC guns burning with air atomizations. Ignitor in burner no.4.
  2. One NRC gun burning CWF with steam atomizations. Second NRC gun with air atomization.
  3. Two NRC guns burning heavy oil with steam atomizations.
- Baghouse tested while burning with CWF with light oil ignitors also in service.
- The first shipment of fuel was burnt by Wednesday evening.
- On Thursday, a hydro test of the new Unit No.3 boiler was started.

C. 3rd Week of Test Program (March 3 to 7, 1986)

- Baghouse test while burning a combination of coal water fuel and heavy fuel oil.
- Burner test - continuous running with both air atomization, and steam atomization while burning CWF.

2. Detailed Discussion

a. Future for the NRC Atomizer Gun:
   - Stand-by atomizer/gun for the Charlottetown CWF test burn.
   - Other application in non-utility boilers.

b. Improvements to burner: After Modifications of the No. 1 burner throat in the Chatham No.1, boiler had been completed which included reshaping the outer burner throat, adding a new inner throat sleeve and swirler,also the primary combination air flow control was improved - this resulted in a much shorter and bushy flame with improved recirculation within the flame. This is the type of flame required for the Charlottetown CWF burn test.

The No.1 burner and the NRC gun gave a good, bright, stable fire. Also this gun/burner arrangement was capable of burning under the following conditions:

1. CWF with air atomization and no support from an ignitor.
2. CWF with steam atomization and no support from an ignitor.
3. Heavy fuel oil with steam atomization and no support from an ignitor.

It should be noted of all the CWF guns tested at Chatham during all the CWF programs this was the only one which would handle steam atomization for a number of hours,this gun/burner ran for 17 hours continuously with steam atomization until the test was discontinued because all the fuel had been burnt.

Copies of the steam flow charts and opacity reading charts that had been recorded during the test programs were presented to the meeting.

c. Fitting an NRC atomizer/gun into the (Cohen) Charlottetown Burners, it was questioned if the gun would be adaptable to the Cohen burner without some modifications to the burner to obtain the required air flow.

d. NRC reported their gun had been demonstrated to have a capacity of 50 to 55 x 10^6 BTU's.

NOTE: The problem with the loss of part of the atomizer tip, prior to the CWF/air atomization test (2nd week) was caused by the use of a thin wall atomizer tip which was being tested, and not the regular thicker ceramics atomizer tip which will not come out the tip holding ring, even if the ceramic parts crack.

e. Where will the next test be conducted?
   - Charlottetown
   - Chatham
   - Sydney Steel
   - a pulp mill boiler

At the present time no plans have been made.

f. There was a great deal of discussion on putting the NRC Atomizer/Gun in the Cohen Burner. Generally it was felt it was expecting too much for the NRC gun to work in the Cohen Burner Register without changes to the air flow.

g. "EMR" do not have the people to develop a burner register to go with the NRC atomizer/gun. They only have Kelly and Horace, and would require a team of about six people to develop a burner register in the required time.

h. A NRC/EMR Burner test (with one gun) could be done in a small industrial boiler (with an air heater) and more than one burner, for example a pulp and paper boiler.

i. Or test just one NRC gun in one of the five burners at Charlottetown.

j. Charlottetown - Schedule

- Baghouse will be installed by June 86.
- Cohen burners company will install their burners in June, 1986.
- The unit must be returned to the original condition, a pressurized boiler by March, 1987.
- The baghouse and I.D. Fan will have to be removed.

k. Fuel to Gun Interaction

NRC had plotted a couple of curves
- one for the CWF delivered to Chatham in the Summer of 1985
- second the first shipment (3 trucks) delivered to Chatham in Feburary 1986, both showing how quickly the viscosity of the fuel dropped.

- part of the same batch of fuel (CWF) is still in storage at the Victoria Junction (fuel preparation plant) and it has not changed in viscosity since it was manufactured.
- the fuel at the Chatham Plant had a rapid reduction in viscosity due to working the fuel, both pumping and passing through the pressure/flow control valves.
- CBDC stated they had no problem with their static storage but they had some problems with the fuel setting up in the their piping on long shut-downs.
- N.B.Power stated they have found it necessary to re-circulate for an hour once a day all the CWF that has been supplied to their Chatham Plant and which was keep in the in-plant storage bunker.
- The reason for this the fuel sets up in the piping (the same as it will in a small can) and settles in the bunker.
- The only fuel that was not recirculated was the three rail cars of CWF held at the plant for 3 months.
- But, after the three months, the fuel settled very rapidly and it was most difficult to remove the fuel from the rail tank cars.

3. Baghouse Test Report (items to be covered)

   - Test on bag materials
   - Method of operating a baghouse when burning a combination of CWF and Oil.
   - The result of the Chatham Baghouse Test.
   - Material samples from the bags which failed were shown to the meeting.
   - NRC will have a clean sample of this material check to ensure it is the material the supplier said it was.

4. Test At Charlottetown

   - NRC gun/atomizer will be a back-up for Charlottetown Cohen burners.
   - Some modification may have to be made to the Cohen Burner Register.
   - Or a new burner register may be required.
   - Can testing of different burners be undertaken at the Charlottetown station?

5. Project Reports

   1. One report from NB Power - Vol. I - burners
      - Vol.II - baghouse
   2. One report from NRC on their gun development.

   A maximum of 12 copies of the report will be required.

6. The reason why good burning was not obtained for the testing during the second week

   - By the time the test was finally undertaken the fuel (CWF) had degenerated to the state where it was not stable and would not burn well.

- There had been no change in the moisture content of the fuel but the viscosity had dropped rapidly.
- This drop in viscosity was also noted with the second shipment of fuel during the third week.
- The 'NRC' gun in the No.1 burner was more tolerant of the change in viscosity.
- The 'NRC' gun in the No.4 burner would not handle the change is viscosity and the fire became unstable.

7. Conclusions of Meeting

1. The NRC gun/atomizer worked well, and NRC have applied to have their design pattern.

2. The burner no. 1 modifications worked well and CANMET EMR are thinking of patterning the burner design.

3. Handling of CWF - do not pump and re-circulate the fuel too much.

4. Efficiency tests were conducted under questionable conditions ie., the fuel had degenerated.

5. Testing in an industrial boiler - there is not enough time to undertake this in time to be helpful for the Charlottetown Project.

6. Commissioning of Charlottetown to start in July.

7. CBDC will have the new equipment in their Victoria Junction plant ready to produce fuel in May/June.

8. In the USA all work on CWF development has been cancelled.

9. EMR/CANMET will stay with the project until it is completed.

10. NRC require sufficient lead time if they are to be involved in future atomizer/gun development and testing.

11. If more testing is required at the Chatham Plant, N.B.Power is willing to consider the request.

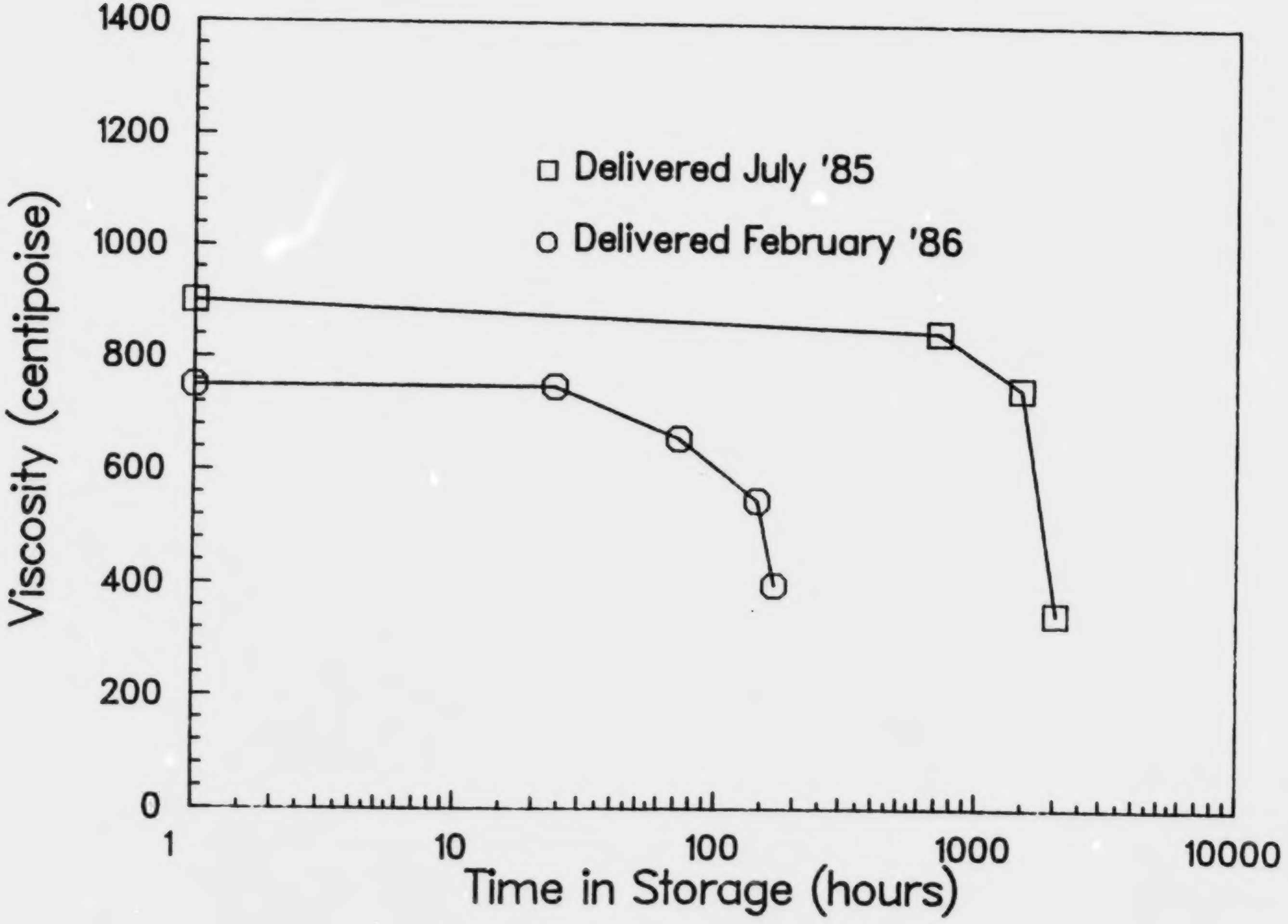
12. The operators at the Chatham Plant will not be available cecause they are now starting the training for the new No.3 boiler, after which they will be involved in commissioning the new systems. If more testing on Unit No.1 is required, operators will have to be brought in from other Plants.

The meeting closed at 4:00 p.m.

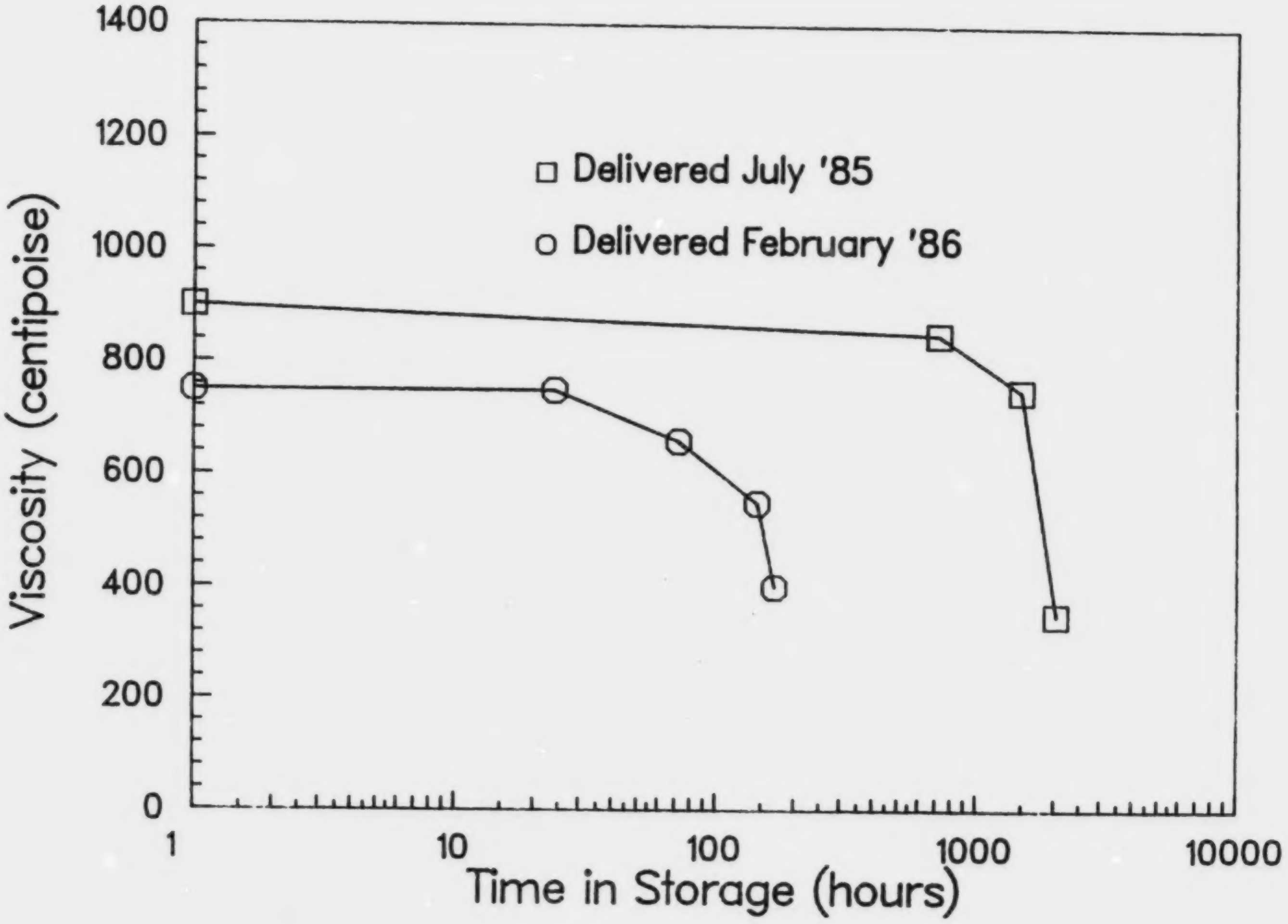
Prepared by

M.R. Thanisch

Viscosity vs Time in Storage



FROM NRC.



Viscosity vs Time in Storage

FROM NRC

N.R.C. BURNER DEMONSTRATION

AT

NB POWER'S CHATHAM T.G. STATION

SECTION 16.6

REPORT ON THE PROBLEMS WHEN REHABILITATING THE SETTLED CWF IN NOVEMBER 1985

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
INTERNAL CORRESPONDENCE

1985-12-17

PLEASE REFER TO OUR FILE NUMBER CWF-4 CHATHAM
Coal/Water Burner Development
NRC Test - Fuel

MEMO TO: D. M. Rankin
Project Manager

SUBJECT: Obtaining Chemicals from C.B.D.C./Carbogel for Reworking the Three Rail Cars of Settled Carbogel Fuel.

Enclosed is a report on the reworking of the above fuel, and list of the correspondence covering our dealings with CBDC/Carbogel during the month of November 1985, while this work was being carried out.

From this, it can be clearly seen CBDC did not have on-site experience or procedures for resolving problems which arise with their fuel after it has left their plant. CBDC represented themselves as having the required knowledge when they insisted they come to Chatham to assist N.B. Power's Chatham site personnel with reworking the settled coal/water fuel.

During the reworking of their settled Carbogel fuel, CBDC's attitude was completely unacceptable to N.B. Power.

They should have had procedures to:

- respond quickly to a customer's problem and request for assistance.
- correct problems with the fuel they have manufactured whether or not the problem was caused by CBDC
- ensure that experienced people are available (or on call) to assist their customers
- provide a back up person with responsibility to act when their Manager is unavailable
- maintain a co-operative attitude towards their customers

M.R. Thanisch
Project Engineering Co-ordinator

Encl
c.c. Don Mac Donald
Chatham Plant

Document Name:
HISTORY/REWORKING CARBOGEL

Requestor's ID:
LD

Author's Name:
M.Thanisch

Document Comments:
History of Reworking the Three Rail Cars of Carbogel Fuel.

1985-11-29

File: CWF-4 NRC Test : Fuel

HISTORY OF RE-WORKING THE THREE RAIL CARS OF CARBOGEL FUEL

Monday - November 4

- First rail car of carbogel fuel was mixed with air lances for sixteen hours, and the fuel went into suspension quite well.
- A sample of this fuel was sent to CBDC's Carbogel Laboratory at Victoria Junction.

Tuesday - November 5

- In a joint phone conversation between the Chatham laboratory and the CBDC Carbogel laboratory it was determined 70 lbs. of C-13 were required in each of the 3 rail cars of fuel.
- The Chatham Plant Chemist reported they were short of the fuel additives (C-13) and they were told by the Carbogel Laboratory (CBDC) they would ship the required C-13 to them.
- A sample of the reworked fuel in the Chatham Laboratory had settled within 24 hours.
- Adrian White was called and asked to have the C-13 shipped as quickly as possible. Mr.White said they did not have any fuel additives on hand and N.B.Power should call either Carbogel Inc. in the USA or A.B.Carbogel in Sweden.
- It was too late in the day to call Sweden, so Carbogel Inc. in New Jersey were called and Peter Beckhuesen said they would check their supplies and contact N.B.Power the following morning.

Wednesday - November 6

- Carbogel Inc. reported they did not have sufficient chemicals in New Jersey to be able to help N.B.Power and suggested that N.B. Power call their manufacturing plant in Elmwood, Tenn. (Stan Bonner).
- Later Adrian White was called by N.B. Power to see if CBDC would have at least 50 lbs. of C-13 so the Chatham Plant personnel could treat one car (there were 25 lbs. in Chatham). In Mr.White's absence, Bob Kazmel was contacted who said he had just returned and would check their supplies.

- Later Mr. Kazmel of CBDC reported to N.B. Power they had 200 lbs. of C-13 and would send 50 lbs. to the Chatham Plant.

- Eric Thomas of A.B.Carbogel in Sweden was called by N.B. Power and asked to arrange to send the Chatham Plant 150 lbs. of C-13. Mr.Thomas said he would check their supplies and have someone call N.B.Power the following morning.

- The Chatham Plant personnel were instructed to go ahead and unload the rail car of remixed fuel as the required 50 lbs. of C-13 were being shipped by CBDC.

Thursday - November 7

- As N.B. Power had not received a call from A.B.Carbogel in Sweden, N.B. Power called and we spoke to Lars Gillberg who said he would check into supplying the required chemicals.

- Bob Kazmel of CBDC advised N.B.Power they would not be sending the C-13 as they (CBDC) required it, and it would take two weeks for CBDC to process a new order. He was told this was deplorable and had put N.B.Power in a bad position, as the Chatham Plant had gone ahead and unloaded the rail car of unstable fuel on the strength of CBDC's advice. He said he was aware of N.B.Power's problem but there was nothing he could do about it.

- Call from Lars Gillberg of A.B.Carbogel in Sweden to N.B. Power to report they had a 100 kilogram drum of C-13 ready to ship to N.B.Power. He was given the shipping instructions and told N.B.Power would resolve the financial arrangements later with CBDC in Sydney.

- Helina Mathieson of Carbogel Inc. in New Jersey called to say she had been asked by Eric Thomas of A.B. Carbogel in Sweden to call N.B.Power. She was told that the matter had been resolved and the chemicals were being shipped to N.B.Power from Sweden. She said she did not think A.B. Carbogel in Sweden could do this and despite the time (8:00 p.m. in Sweden) she would call someone there to check what had been done.

Friday - November 8

- A telex was received by N.B. Power from A.B.Carbogel in Sweden signed by Eric Thomas (Mrs.Matherson had said he was in hospital) reporting they could not supply the chemicals and N.B.Power should work through CBDC in Sydney, Nova Scotia.

- An answer was sent by N.B. Power to Mr.Thomas saying N.B.Power had always worked with CBDC and they (CBDC) had advised N.B.Power to contact A.B.Carbogel in Sweden.

Monday - November 11 - Remembrance Day - Holiday

Tuesday - November 12

- N.B. Power attempted to call CBDC but their phones at their Sydney office were out of order.

- Bob Kazmel of CBDC at Victoria Junction was called by N.B. Power and he said he did not know if Adrian White had ordered the C-13 for Chatham but he would check into it.

Wednesday - November 13

- The Chatham Plant operators reported that they had developed a boiler leak while bringing the unit No. 1 boiler up to temperature and pressure.

- Adrian White of CBDC was called by N.B. Power and in his absence, his assistant, John Campbell, said he did not know anyting about N.B.Power's requirements.

- Therefore, Bob Kazmel, CBDC was called by N.B. Power and Mr. Kazmel reported he had been instructed by Adrian White to send nothing to N.B.Power until he had received a purchase order from them (N.B.Power) for both the C13 and two of their people to go to the Chatham Plant to rework the fuel. He was asked to have Adrian White call N.B.Power.

- Adrian White called N.B. Power from Pittsburgh USA and insisted they would not order the C-13 from Sweden until they received a purchase order from N.B.Power.

- He was told N.B.Power had no objections to issuing an order to CBDC for the supply of the C-13 and, as always, their people were welcome to come to N.B.Power's Chatham Plant to obtain some experience in handling their Carbogel fuel in the field but, there was no way N.B.Power could justify issuing a purchase order to employ CBDC's staff as experts in reworking fuel in the field as they had no field experience; whereas, N.B.Power's own personnel at the Chatham Plant had reworked coal water fuels a number of times over the past two years, both Carbogel and OX-CE fuels. Mr.White was quite adamant in stating that if N.B. Power did not issue a purchase order for his staff, CBDC he would not order the C-13 from Sweden.

- Mr. White was told by N.B. Power this could be considered 'black-mail' and said we could call it whatever we liked. As an impasse had been reached, the call was transferred to Dave Rankin (the Project Manager).

- Later Mr.Rankin sent a telex to Adrian White of CBDC requesting a quotation for the supply of 200 pounds of C-13 (stabilizer).

Thursday - November 14

- A telex was received by N.B.Power from Adrian White stating the C-13 would cost $3.05 (Canadian) per kilogram, and it would only be supplied with CBDC technical personnel to supervise the addition of the chemicals at the Chatham Plant.

- As no rates were given for the CBDC technical personnel, it was assumed they would be charged at payroll cost - the same way as N.B.Power is paid for their involvement in these projects.

Friday - November 15

- A purchase order (via telex) was issued by the Chatham Plant Stores to CBDC for the supply of 100 kilograms of C-13 and $2,500.00 for labour (including expenses). This labour estimate was:

Labour (6 mandays) = 50 hours at $30/hour =	$ 1,500.00
Travel (via road) =	500.00
Living Cost (hotel and meals) =	500.00
TOTAL	$ 2,500.00

- CBDC were asked to submit the names and experience of the people they were proposing to send to Chatham in advance for approval.

Monday - November 18

- Adrian White of CBDC sent a telex to N.B.Power with the names of their personnel they proposed to send to Chatham and their hourly rate. These people left Sydney before receiving N.B.power's approval.

Tuesday - November 19

- The two CBDC people arrived at the Chatham Plant and did some viscosity checks of the fuel with their own equipment, and left instructions for the Chatham Plant personnel on the evening and night shifts to add B-3 (dispersant) to the second rail car of carbogel fuel.

- Initially the CBDC people wanted to make all their chemical additions in the bunker but they were told this was impractical for three reasons:

One: The N.B. Power site personnel were having problems keeping the coal in suspension once the carbogel had been remixed, therefore some chemicals were required to keep the coal in suspension while the fuel was being unloaded.

Two: Remixed but untreated fuel could not be put in the bunker with fuel that had been reworked.

Three: The bunker was not available for mixing fuel because N.B. Power and NRC were conducting a gun/atomizer test program.

Wednesday - November 20

- In the morning the CBDC staff claimed they had exceeded the $2800.00 ceiling of the purchase order although they had only been at the Chatham Station for a few hours and had not reworked any of the settled carbogel fuel, or supplied any of the C-13 to N.B. Power. Some viscosity measurements were taken and a handwritten report was given to N.B. Power, also a quantity of B-3 dispersant had been added to the second rail car by N.B. Power's personnel following instruction given by the CBDC people.

- After a short meeting and a number of phone calls the CBDC staff were given a letter telling them under the terms of the P.O. they were required to complete the reworking of the second and third rail cars of fuel. N.B. Power had already completed reworking the first car of fuel.

- At noontime Greg Landry (CBDC's Engineer in Chatham to assist with reworking their fuel) spoke by phone to Adrian White of CBDC and when he had finished the phone call he said, "We are all through." When asked if this meant they were leaving he said, "Oh, no! I have just finished my call with Adrian White." When asked if and when they would be leaving Greg answered, "That would depend on when N.B. Power started paying them."

- It was assumed by N.B. Power from this short conversation that the CBDC staff would be staying and it was quite a surprise a couple of hours later when Don MacDonald, the Chatham Plant Manager reported the two CBDC people were in the process of leaving the site.

- Another meeting was held with Greg Landry, of CBDC and he was asked in view of the lunchtime conversation what was going on.

- Mr.Landry replied he had a second phone conversation with Adrian White and had been told to leave the site once he calculated they had reached the cost ceiling of the P.O. regardless to how much work had been completed.

- Mr.Landry added he had told Adrian White that N.B. Power were most annoyed about being advised by CBDC to contact A.B. Carbogel in Sweden, and after they had spent some time arranging to have the required C-13 stabilizer shipped someone had put a stop to the shipment.

- Mr.Landry reported Mr.White had said he had told N.B. Power to contact A.B. Carbogel to obtain the C-13 but he did not consider he had sent N.B. Power on a "wild goose chase."

- As Mr.Landry had no authority Don MacDonald called Adrian White and offered to issue a second P.O. to CBDC for $800.00. (The Chatham plant are limited as to the amount of a P.O. they can issue from the plant, this was the reason why the value of the first P.O. could not be increased.) This second P.O. would have allowed CBDC staff to at least stay at the Chatham plant that evening to add the C-13 stabilizer to the second rail car of remixed fuel which N.B. Power was ready to start unloading. Adrian White refused to accept this second P.O. and his people left the Chatham plant. It was later discovered that CBDC had removed, without obtaining N.B. Power's approval, all the B-3 dispersant which had been at the Chatham Plant since 1983. (N.B.Power have no record of receiving a request from CBDC for the return of the B-3).

- N.B. Power advised CBDC all they required from them was the C-13 stabilizer and written instruction on how it should be added to the reworked fuel.

- CBDC said they would not do this as it was their technology.

- N.B. Power advised CBDC that a precedent had already been set as all the chemicals had been supplied to N.B. Power in the past, and the B-3 dispersant had been added by N.B. Power's personnel to the second car the previous evening following CBDC's instructions, when they (CBDC) were absent from the Chatham plant.

- The Chatham personnel unloaded the second car of fuel on the night-shift, while the boiler was shut down.

Thursday - November 21

- In the morning after speaking to Adrian White of CBDC, Dave Rankin of N.B. Power sent a telex to CBDC raising the ceiling of the first P.O. to $3,000.00 and issuing a second P.O. for $3,000.00.

- Later in the morning the CBDC staff returned to the Chatham plant but did not add the C-13 to the fuel in the storage bunker until late that evening by which time some of the fuel had been burnt. This delay was due in part to the time it took the CBDC staff to mix up one drum of the C-13 stabilizer. CBDC took about 2 hours, whereas the Chatham plant chemist required only 15 minutes, by using warm water instead of cold.

- In the meantime the Chatham site personnel had been working on remixing the third rail car of fuel and were experiencing problems keeping the fuel in suspension once it had been remixed because there were negligible chemicals left in it.

Friday - November 22

- The CBDC people again refused to treat any more fuel (the third car that time) and said they were leaving the Chatham site because they calculated the ceiling of the second P.O. had been reached. This was confirmed by Adrian White.

- Don MacDonald had no choice but to issue a third P.O. to CBDC to keep their people at the Chatham Plant, so his plant could obtain the required chemicals to be able to stabilize the third and final rail car of fuel.
- CBDC had already been told their payments would be based upon approved time sheets.

Saturday - November 23

- By lunchtime all the chemicals (B-3, C-13 and formalin) had been added, at N.B. Power's insistance, to the fuel while it was still in the third rail car, and the two CBDC people left the Chatham plant.
- N.B. Power had to obtain the formalin directly from the supplier in Montreal.
- The fuel and chemicals were well mixed in the rail car before the reworked was unloaded.

All the reworked carbogel fuel was burnt by 1:50 a.m. on Tuesday, November 26, 1985.

Prepared by: ______________________
M.R. Thanisch
Project Engineering
Co-ordinator

Document Name:
TB/CORRESPONDENCE COVERING THE

Requestor's ID:
LD

Author's Name:
Mike Thanisch

Document Comments:
Re-Working Of The Three Rail Cars Of Settled Carbogel Fuel

FILE: CWF-4
NRC TEST FUEL
DATE: 3 DECEMBER 1985
PAGE: 1

CORRESPONDENCE COVERING THE RE-WORKING OF THE THREE RAIL CARS OF SETTLED CARBOGEL FUEL AT THE CHATHAM STATION

REF. NO.	DATE	TO	FROM	BY	SYNOPSIS
1	5 Nov. 85	Mike Thanisch N.B. Power	Francine Thibodeau-Landry N.B. Power Chatham	Phone	Report on Reworking settled Carbogel and the need for chemicals.
2	7 Nov. 85	Lars Gillberg A.B. Carbogel Sweden	Mike Thanisch N.B. Power	Telex	To obtain Mike Thanisch's phone no., later Lars called to report the C-13 was ready for shipment.
3	8 Nov. 85	Mike Thanisch N.B. Power	Eric Thomas A.B. Carbogel Sweden	Telex	Telex to tell N.B. Power to obtain the required chemicals from C.B.D.C.
4	8 Nov. 85	Eric Thomas A.B. Carbogel Sweden	Mike Thanisch N.B. Power	Telex	Answer to A.B. Carbogel correcting their comments and telling them again N.B. Power had been advised by C.B.D.C. to contact A.B.Carbogel.
5	8 Nov. 85	D.M. Rankin N.B. Power	Mike Thanisch N.B. Power	Memo	Report covering all the problems of the previous week when trying to obtain the required chemicals from C.B.D.C./A.B.Carbogel.
6	13 Nov. 25	D.M. Rankin N.B. Power	Mike Thanisch N.B. Power	Memo	Report on the latest problems with C.B.D.C. /A.B. Carbogel.

CORRESPONDENCE COVERING THE RE-WORKING OF THE THREE RAIL CARS OF SETTLED CARBOGEL FUEL AT THE CHATHAM STATION

REF. NO.	DATE	TO	FROM	BY	SYNOPSIS
7	13 Nov. 85	A.B. Carbogel Sweden	D.M. Rankin N.B. Power	Telex	Request for chemicals.
8	13 Nov. 85	A. White C.B.D.C.	D.M. Rankin N.B. Power	Telex	Request for Chemicals
9	14 Nov. 85	D.M. Rankin N.B. Power	Eric Thomas A.B. Carbogel	Telex	Telling N.B. Power to deal with C.B.D.C.
10	14 Nov. 85	D.M. Rankin N.B. Power	A. White C.R.D.C.	Telex	Quotation from CBDC for the cost of the C-13, and adding the will not supply the C-13 unless they are also given a purchase order for their staff to go to Chatham to add the C-13.
11	15 Nov. 85	A. White C.B.D.C.	Joe Young N.B. Power Chatham	Telex	Order for 100 kilograms of C-13 and $2,500.00 for C.B.D.C. labour, including expenses and travel.
12	18 Nov. 85	Yoe Young Chatham	A. White C.B.D.C.	Telex	Listing the C.B.D.C. personnel going to Chatham, and their rates and conditions.

CORRESPONDENCE COVERING THE RE-WORKING OF THE THREE RAIL CARS OF SETTLED CARBOGEL FUEL AT THE CHATHAM STATION

REF. NO.	DATE	TO	FROM	BY	SYNOPSIS
13	19 Nov. 85	Greg Landry C.B.D.C.	Mike Thanisch N.B. Power	Letter (By Hand)	Telling C.B.D.C. they are to supply N.B. Power with detailed reports on all their work at the Chatham plant.
14	19 Nov. 85	D.M. Rankin N.B. Power	A. White C.B.D.C.	Phone	Dave Rankin asked: -Why is it necessary for two C.B.D.C. people to be in Chatham when they are only there to give advise? -and stated C.B.D.C. are to rework all the Carbogel at the Chatham Plant covered by the P.O.
15	20 Nov. 85	D.M. Rankin N.B. Power	A. White C.B.D.C.	Phone	Adrian White reported it will take a week to rework the settled fuel. Therefore, they require the ceiling on the P.O. raised or their people will return to Sydney.
16	20 Nov. 85	Greg Landry C.B.D.C.	Mike Thanisch N.B. Power	Letter (By Hand)	Telling C.B.D.C. they are to treat all the Carbogel fuel at the Chatham plant as per the purchase order.

CORRESPONDENCE COVERING THE RE-WORKING OF THE THREE RAIL CARS OF SETTLED CARBOGEL FUEL AT THE CHATHAM STATION

REF. NO.	DATE	TO	FROM	BY	SYNOPSIS
17	20 Nov. 85	D.M. Rankin N.B. Power	A. White C.B.D.C	Telex	Reporting their people have left Chatham and are enroute to Sydney.
18	21 Nov. 85	M.Thanisch	Files	Report	Problems encountered during site visit November 19/20, 1985.
19	21 Nov. 85	A. White C.B.D.C.	D.M. Rankin N.B. Power	Telex	Raising the first P.O. to $3,000 and issuing a second P.O. for $3,000.
20	22 Nov. 85	A. White C.B.D.C.	Don MacDonald N.B. Power Chatham	Phone	Issuing a third P.O. to C.B.D.C. when they again threatened to leave the site.
21	25 Nov. 85	Mike Thanisch N.B. Power	Don MacDonald N.B. Power Chatham	Phone	To report the C.B.D.C. people left the Chatham plant on Saturday after finally adding the chemicals to the last rail car.
22	25 Nov. 85	D.M. Rankin N.B. Power	Don MacDonald N.B. Power Chatham	Memo	Problems with C.B.D.C. regarding reworking the fuel.

1

RECORD OF TELEPHONE CONVERSATION

FILE NUMBER: CWF 4 NRC Test - Fuel

DATE: 5 November 1985

TIME: 2:30 PM

CALL FROM: Francine

FIRM: N.B. Power - Chatham

RECEIVED BY: Mike Thanisch

FIRM: N.B. Power - Fredericton

GENERAL TOPIC OF CONVERSATION:

RE-WORKED CARBOGEL FUEL

SYNOPSIS OF DISCUSSTION:

Francine reported:

(1) A sample of the re-worked fuel she had taken from the rail car yesterday had settled by today (within 24 hours).

(2) She called C.B.D.C. at Victoria Junction and spoke to Debbie, in the lab, as both Bob Kazmel and Greg Landry were away.

(3) As the fuel is settling so quickly they calculated 70 pounds of chemicals would have to be added to each of the 3 rail cars. They only have 30 pounds in Chatham and no formalin to sterilize the fuel before adding the chemicals.

(4) Debbie said she would arrange to send some extra chemicals to the Chatham plant.

I told Francine I would call Adrian White at C.B.D.C. in Sydney to have both the formalin and chemicals shipped as soon as possible.

M.R. THANISCH

2

File: CWF 4 Chatham
Coal/Water Burner Development
NRC TEST. FUEL
Date: 7-Nov-85

‡
NBEPC PSDO FRN

FROM : AB CARBOGEL, SWEDEN
TO : CHATHAM STATION NEW BRUNSWICK
ATT : MIKE TANISH Mike Thanisch

COULD YOU PLEASE GIVE US YOUR TELEFPHONE NUMBER ?

THANK YOU VERY MUCH IN ADVANCE

LARS GILLBERG

@@@@@@@@@@@@@
@@@@@@@@@@@@@

72841 CARBOG S‡
NBEPC PSDO FRN
MOM PLS OK DO YO WANT THE CHATHAM PHOME NO OR THE NO FOR THS T
HANISCH++++++++@@@@MOM, I HAVE A PHONECALL

FOR MR THANISHEN, PLEASE AND CHATHAM PHONE - THANKS

OK THANISCH NUMBER IS AREA CODE 506-4583038 THAT IS AREA CODE 506 A
ND THE PHONE NO IS 458-3038..... THE NUMBER FOR THE CONST. SITE AT CH
ATHAM IS AREA CODE 506 NUMBER 773-94810K?????

OK - THANK YOU VERY MUCH .

REGARDS
LARS GILLBERG

72841 CARBOG S‡
NBEPC PSDO FRN
‡‡

3/

File: CWF...4 Chatham
Coal/Water Burner Development
NRC TEST - FUEL
Date: 8 Nov 85

NBEPC PSDO FRN

FOR THE ATTENTION OF MR. MIKE THANISCH - NBEPC

1985.11.08

FROM : AB CARBOGEL, SWEDEN
TO : MR. MIKE THANISCH - NBEPC

COPY TO : ADRIAN WHITE
MIKE MATHIESEN
PHIL READ

O/R : 382/EJT

SUBJECT REF - YOUR TELECON WITH ME 06 NOV. CONCERNING YOUR REQUEST FOR 150 LBS. WT. CARBOFIX ~~B2~~ STABILISER.
C-13

WE HAVE REVIEWED YOUR REQUEST FOR ~~B2~~ C-13 STABILISER AND HAVE CONSULTED OUR LICENCEES CAPE BRETON DEVCO THE FOLLOWING POINTS ARE RELEVANT.

AAA.
WE ARE ADVISED BY CB DEVCO THAT THE COAL WATER FUEL WAS SUPPLIED TO CHATHAM SEVERAL MONTHS AGO, AND THE CWF/RAIL CARS IN QUESTION HAVE BEEN STANDING AT CHATHAM FOR THIS PERIOD WITHOUT EXAMINATION AND INTERMITTENT STIRRING.

BBB.
YOUR DIAGNOSIS OF REQUIREMENT OF C13 IS NOT NECESSARILY CORRECT. AFTER SUCH A LONG PERIOD STANDING IN RAIL CARS AT CHATHAM THERE MAY BE NEED FOR OTHER CHEMICAL ADDITIVES TO BE SUPPLIED - ASSUMING OF COARSE THAT THE CWF IS RECONSTITUTABLE NOW. ONLY CBDC SKILLED PERSONAL CAN ASCERTAIN SPECIFIC REQUIREMENTS AND SPECIFIC (REPEAT SPECIFIC) AMOUNTS OF ADDITIVES REQUIRED. YOU MUST THEREFORE NEGOTIATE WITH CBDC (MR. ADRIAN WHITE) OVER SUPPLY OF PERSONEL, ANALYSIS OF THE CWF IN QUESTION AND SUPPLY OF CORRECTIVE ACTION AND ADDITIVE(S).

CCC.
I UNDERSTAND THAT SOME C13 WAS PROMISED TO NBEPC BY CBDC LAB. STAFF- BUT THIS IS NOT THE PROPER PROCEDURE, AND YOU MUST CONTACT ADRIAN WHITE IN THIS REGARD.

PAGE 2 OF 2

DATED - 8 NOV 85

DDD.
THROUGH OUR LICENCE AGREEMENT WITH CBDC WE ARE NOT PERMITTED TO SUPPLY NBEPC OR ANY OTHER IN THE LICENCED TERRITORY WITH ADDITIVES ONLY CBDC ARE ENTITLED TO DO THIS.

EEE.
BOTH NBEPC AND THE N.R.C. PEOPLE MUST EXPECT THE PROPER SPECIFICATION FUEL TO BE SUPPLIED TO THE BURNER FOR TESTING - OTHERWISE THE TEST WILL NOT BE MEANINGFUL, AND A ADVERSE PERFORMANCE OF THE BURNER WOULD BE BLAMED ON THE FUEL THROUGH NO FAULT OF CBDC OR CARBOGEL. NBEPC STAFF ARE NOT QUALIFIED TH SPECIFIY WHICH ADDITIVES OR WHAT AMOUNTS ARE REQUIRED, OR IN RE-CONDITIONING THE FUEL. ANY RESULTING FUEL FROM NBEPC'S EFFORTS COULD NOT BE CALLED CARBOGEL AND WOULD BE GROSSLY UNFAIR TO N.R.C., NBEPC AND ALL OTHER PARTIES INVOLVED.

FFF.
CARBOGEL IS PREPARED TO SUPPLY ANY AMOUNT OF ADDITIVES TO CBDEVCO THAT CBDEVCO CONSIDER NECESSARY. BUT ONLY CBDEVCO CAN CORRECTLY SPECIFY WHAT IS REQUIRED - AND ONLY CBDEVCO ARE QUALIFIED IN THEIR TERRITORY TO LABEL ANY FUEL AS SPECIFICATION CARBOGEL.

GGG.
BY THIS TELEX I ADVISE YOU TO NEGOCIATE WIHT MR. ADRIAN WHITE FOR SUPPLY OF CBDEVCO SERVICES AND/OR PURCHASE OF FRESH CWF.
I HAVE ADVISED OUR DR. LARS GILLBERG ACCORDINGLY.

BEST REGARDS
ERIC J.. THOMAS

CORRECTION : SUBJECT REF SHOULD READ C 13 INSTEAD OF B 3
LINE 1 SHOULD READ C 13 INSTEAD OF B 3

SORRY FOR THE ERROR.

SEE ANSWER DATED
8 NOV 85

72841 CARBOG S
NBEPC PSDO FRN

0500
183451 0922 081185
INTLX MTL CA +
NBEPC PSDO FRN

4/

File: CW/ 4 Chatham
Coal/Water Burner Development
NRC TEST - FUEL
Date: 8 Nov 85

PTS
54728414
72841 CARBOG S+
NBEPC PSDO FRN

GA

NOVEMBER 8, 1985

ATTN: MR ERIC THOMAS
A B CARBOGEL - SWEDEN

SUBJ: RE-WORKING OF COAL WATER FUEL (CWF), SUPPLIED BY CBDC

IN ANSWER TO YOUR TELEX DATED 8 NOV. 85 WE WILL, AS ALWAYS BE DEALING WITH ADRIAN WHITE OF CBDC. BUT JUST FOR THE RECORD, WE WILL GO OVER THE FOLLOWING POINTS WHICH WERE COVERED WITH ALL THE PEOPLE WE HAVE SPOKEN TO THIS WEEK.

1. A SAMPLE OF THE RE-MIXED C.W.F. WAS SENT TO CBDC.
2. THE CHEMICAL REQUIREMENTS WERE DETERMINED BY THE CBDC LABORATORY.
3. WHEN WE WERE ADVISED BY CBDC THEY COULD NOT SUPPLY THE CHEMICALS THAT WERE REQUIRED, THEY SUGGESTED WE CONTACT EITHER A B CARBOGEL IN SWEDEN, OR CARBOGEL INC. IN N.J. DIRECTLY.
4. ON WEDNESDAY NOV. 6 AFTER WE HAD BEEN TOLD BY PETER BECKHUSSEN OF CARBOGEL INC., THEY DID NOT HAVE SUFFICIENT C-13 TO MEET OUR REQUIREMENT WE CALLED YOU AT 11:25 AM (4:30 PM IN SWEDEN) AND THOUGHT AFTER OUR CONVERSATION THE MATTER WAS RESOLVED.
5. AT NO TIME HAS ANYONE BEEN TOLD THIS IS A TEST OF CARBOGEL FUEL.

   IT IS JUST A METHOD OF DISPOSING OF THE THREE RAIL CARS OF CWF NOW IN CHATHAM.
6. THEREFORE WE WERE VERY SURPRISED TO RECEIVE YOUR TELEX THIS MORNING AND FIND WE ARE BACK TO WHERE WE WERE ON TUESDAY, AND HAVE LOST FOUR VERY IMPORTANT DAYS.
7. I AM SORRY TO HEAR YOU HAD TO GO IN TO HOSPITAL.

   BEST WISHES FOR YOUR SPEEDY RECOVERY.

REGARDS

MIKE THANISCH
NB POWER

CC: ADRIAN WHITE - CBDC - SYDNEY NS
TLX - 019-35132

MIKE MATHIESEN - CARBOGEL INC.
NEW JERSEY
TLX 82813

PHIL READ - EMR OTTAWA
TLX 053-3117

J+
72841 CARBOG S
NBEPC PSDO FRN

Document Name:
MO/851108/DAVE RANKIN

Requestor's ID:
CAH

Author's Name:
M.Thanisch

Document Comments:
Reconstituting Carbogel Fuel at the Chatham Plant.

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
INTERNAL CORRESPONDENCE

5

PLEASE REFER TO OUR FILE NUMBER CWF 4 CHATHAM

Coal/Water
Burner
Development
NRC Test -
Fuel

MEMO TO: Dave Rankin
Project Manager

1985-11-08

SUBJECT: Re-Working the Coal Water Fuel (Carbogel)

1. Background to Problem

1.1 A sample of the remixed CWF (Carbogel) fuel from one of the rail cars now in Chatham was sent to CBDC at Victoria Junction for analysis. It was agreed between Francine, the Chatham Plant Chemist, and Debbie, who works in the laboratory at the Carbogel fuel preparation plant at Victoria Junction (both Bob Kazmel and Greg Landry were away) that 70 pounds of stabilizer (Chemical C-13) was required in each of the three rail cars. As there was only 25 pounds of C-13 at the Chatham Plant, Debbie said she would arrange to have the required chemicals shipped to the Chatham Plant.

1.2 It should be noted that a sample of the remixed Carbogel in the Chatham Plant laboratory settled overnight and was so solid the next day that a spatula which had been left in it could not be removed.

2. Tuesday - November 5, 1985

2.1 When Francine reported to me of the state of the Carbogel, and their requirement for extra chemicals (C-13), I told her I would call Adrian White to ensure the C-13 was shipped as quickly as possible.

2.2 I called Adrian White on Tuesday afternoon, and he told me he knew of our requirements but they did not have enough C-13 to ship to us. He suggested I call either Peter Beckhussen at Carbogel Inc., in New Jersey, or Eric Thomas at A.B.Carbogel in Sweden.

2.3 I could not call Sweden because their time is 5 hours ahead of eastern Canada, so there would have been no one in their office at that time. For this reason, I called Peter Beckhussen at Carbogel Inc. in New Jersey (at 4:15 p.m.). Mr.Beckhussen said he did not know how much chemicals they carried in stock and he would check and let me know.

3. Wednesday - November 6, 1985

3.1 First thing in the morning Francine, the Chatham Plant Chemist, called to find out when the C-13 would be shipped from CBDC. When I told her CBDC could not supply enough chemical for three rail cars, she asked if they would have at least 50 pounds, to add to the 25 pounds they already had in Chatham, so they could treat the one rail car of CWF they were waiting to unload.

3.2 I called Adrian White at 8:35 a.m. and was told he had not arrived in the office, so I left a message regarding the 50 pounds of C-13.

3.3 Later Bob Kazmel of CBDC called to say Adrian White was at a meeting in Halifax but he would check how much C-13 they had in stock.

3.4 Bob Kazmel called back and said they had one, 100 Kilogram drum (220 pounds) and he would ship 50 pounds to Chatham right away, by the quickest method.

3.5 I called the Chatham Plant and told them they could go ahead and unload the rail car of remixed (but unstable) CWF as the required C-13 chemical should arrive on Thursday.

3.6 At 11:00 a.m., I called Peter Beckhussen at Carbogel Inc. and was told they only carried small quantities of chemicals, so they did not have sufficient to send to N.B.Power to treat 3 rail cars. He suggested I call Stev Bonner at the Carbogel Plant in Elmwood, Tenn.

3.7 As I did not wish to involve any new people, I thought it would be better to call Eric Thomas in Sweden (also there was still time to call A.B. Cargogel before they went home).

3.8 At 11:25 a.m. (4:25 p.m. in Sweden), I spoke to Eric Thomas and told him the details of our problem, and we had been advised by CBDC to call him. He said he would check their supplies, make arrangements for shipping, and have someone call me Thursday morning with the shipping details. He could not do it himself as he would be leaving to go to Italy.

4. Thursday - November 7, 1985

4.1 At 10:30 a.m. (3:30 p.m. in Sweden), as I had not received a call from A.B.Carbogel in Sweden, I called and spoke to Lars Gillberg. He said he had not been told of our problem but they were having a meeting of their staff so they would be able to deal with it right away.

4.2 Call from Bob Kazmel to report he had not shipped the 50 pounds of C-13, as promised because he had found they (CBDC) had to produce two tankers of Carbogel fuel this week to ship to Italy. He added he was aware of our situation but could do nothing about it.

4.3 12:25 p.m., call from Lars Gillberg to report they had a 100 Kilogram drum of C-13 available which they would ship directly to the Chatham Plant (Attention: Don MacDonald) and would telex the shipping details to me.

4.4 Thursday afternoon, I received a phone call from Helena Mathiesen of Carbogel Inc. in New Jersey to report Eric Thomas had to go into hospital and he had asked her to call me.

I told her the matter had been resolved with Lars Gillberg who would be shipping the required chemicals to N.B.Power.

Mrs.Mathiesen said she did not think he would be able to do this so she would check into it.

I asked her how she would do this as it was already quote late in Sweden. She said this would be no problem as she could call some people at their homes.

5. Friday - November 8, 1985

5.1 I received the attached telex from Eric Thomas in Sweden and sent him the enclosed answer. Now I do not know if, or when, we will receive the required chemicals to treat the coal water fuel now in the bunker in Chatham.

5.2 As usual, A.B.Carbogel have spent all their time trying to protect themselves, and no time helping to solve the problem with their fuel.

6. Later

6.1 I understand after I told you of this matter you have spoken to Dr. Phil Read at EMR in Ottawa, who in turn called A.B. Carbogel.

6.2 Also you spoke to Adrian White at CBDC in Sydney.

6.3 What has been arranged?

1d

M. R. Thanisch
Project Engineering Co-Ordinator

c.c.
Don MacDonald (Chatham Plant)
Jack Flanagan (Chatham Plant)
Keith Keoughan (Chatham Plant)
Francine Thibodeau-Landry (Chatham Plant)

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
INTERNAL CORRESPONDENCE

6

PLEASE REFER TO OUR FILE NUMBER CWF-4
NRC Test - Fuel

MEMO TO: D.M. Rankin
Project Manager

1985-11-13

SUBJECT: Problems with CBDC (Carbogel)

Again we have been getting the run around from CBDC (Carbogel). First thing this morning, I tried to call Adrian White in Sydney and as he was away, I spoke to John Campbell who said he did not know anything about our requirements for coal water fuel (CWF) chemicals to treat the three rail cars of their fuel now at the Chatham Plant. The reason for this he had been away, so he recommended I call Bob Kazmel at the Victoria Junction (Carbogel) Plant.

I called Bob Kazmel who said he had been told by Adrian White not to issue any chemicals to N.B.Power until he had received a purchase order from us (N. B. Power) to send two of their people (from Victoria Junction) to Chatham to check the fuel (CWF).

He added there was nothing he could do for us, and I should speak to Adrian White, who was out of the country at the present time. He added that Louise Matherson in their Sydney office would know where Adrian could be contacted.

I tried to call Louise, only to find CBDC's phones were out of order again today.

By placing the call through their switchboard, I was able to contact Louise who said she would call Adrian White and have him return my call. I impressed upon her the urgency of this matter.

ld

M. R. Thanisch

M. R. Thanisch
Project Engineering Co-ordinator

c.c.
D.MacDonald (Chatham)
J.Flanagan (Chatham)

7

File: 61-1-4 Chatham
[illegible] Burner Development
NRC TEST - FILE
Date: 13 Nov 85

0500
428340 1525 131185
INTLX MTL CA ‡
NBEPC PSDO FRN

PTS
54728 41+
72841 CARBOG S‡
NBEPC PSDO FRN

GA

NOV. 13/85

AB CARBOGEL

SUBJ: C13 STABILIZER

ADDITIONAL C13 STABILIZER IS REQUIRED IN ORDER TO REHABILITATE OLD FUEL AT CHATHAM NEW BRUNSWICK. CBDC DOES NOT HAVE SUFFICIENT TO SUPPLY US WITH ANY AND HAS SUGGESTED WE CONTACT AB CARBOGEL.

1. WILL AB CARBOGEL SUPPLY APPROXIMATELY 200 LBS. OF C13 STABILIZER TO NB POWER.

2. PLEASE ADVISE PRICE OF C13 STABILIZER AND PRICE FOR AIR SHIPMENT AND DELIVERY DATE.

ON RECEIPT OF THE ABOVE NB POWER WILL, WITH THE APPROVAL OF EMR CANADA PLACE A PURCHASE ORDER FOR THE STABILIZER.

PLEASE REPLY IMMEDIATELY TELEX 014-46285.

NB POWER
D.M. RANKIN
┘‡
72841 CARBOG S
NBEPC PSDO FRN

8

File: 4.1.4 Chatham
Coal Water Burner Development
NRC Test - Files
Date: 13 Nov 85

019351321
DEVCO GLBY

NBEPC PSDO FRN

NOV. 13/85

CBDC SYDNEY NS

ATTN: A. WHITE

SUBJ: STABILIZER CB

PLEASE ADVISE PRICE AND DELIVERY OF APROXIMATELY 200 POUNDS C13 STABILIZER DELIVERED TO CHATHAM N.B.

SUBJECT TO ACCEPTABLE DELIVERY A PURCHASE ORDER WILL BE PLACED FOR THIS MATERIAL.

SHOULD WE FEEL WE REQUIRE YOUR LABORATORY PEOPLE AT CHATHAM.

A SEPARATE PO WILL BE RAISED.

PLEASE REPLY IMMEDIATELY.

NB POWER
D.M. RANKIN
J‡
DEVCO GLBY

NBEPC PSDO FRN

NBEPC PSDO FRN

1985.11.14

9

FRO THE ATTENTION OF MR. DAVID RANKIN - NBEPC

File: CWF 4
NRC TEST : FUEL
14 Nov 85

FROM : AB CARBOGEL, SWEDEN
TO : NBEPC, CANADA
ATT : MR. DAVID RANKIN

COPIED TO : A. WHITE - CB DEVCO
P. READ - EMR
M. MTHIESEN - CARBOGEL INC.

O/R 393/EJT

SUBJECT REF 1 - YOUR TELEX OF 13 NOV. 85 AND C13 STABILISER
2 - PLEASE ALSO REFER TO MY TELEX 382/EJT OF 08 NOV 85 TO YOUR MR. M. THANISCH.

AAA.
I AM ADVISED BY CB DEVCO PLANT LABORATORY PERSONNEL (FOLLOWING DIALOGUE WITH AB CARBOGEL'S LAB.) THAT DISPERSANT ADDITIVE IS REQUIRED PLUS STABILISER ADDITION.

BBB.?
PLEASE REFER TO PARA BBB, DDD, AND EEE OF MY TELEX 382/EJT - I EMPHASISE PARA BBB.

CCC.
I HAVE DISCUSSED THE ISSUES WITH MR. ADRIAN WHITE (09 NOV.) AND AGREED THAT THE SOLUTION IS BETWEEN NBEPC AND CB DEVCO , AND ADVISE YOU TO NEGOTIATE WITH CB DEVCO OVER SUPPLY OF ADDITIVES, QUALIFIED STAFF (TO RECTIFY CWF HELD AT CHATHAM FOR MONTHS) AND PLANT/ TECHNIQUES NECESSARY TO BRING CWF BACK TO SUITABLE CONDITION.

DDD.
THE RESPONSIBILITY FOR SUPPLY OF ADDITIVES IN CANADA TO NBEPC IS WITH CBDC - I BELIEVE THEY HOLD SUFFICENT STOCKS. *

EEE.
ACCORDING TO YOUR TELEX REIMBURSE CARBOGEL (WITH ORDER NUMBER) WITH THE APPROVAL OF EMR - THIS IMPLIES THAT SOMEHOW RESPONSIBILITY LIES WITH CARBOGEL WHICH IS CLEARLY NOT THE CASE - REF. PARA AAA. OF MY TELEX 382/EJT.

FFF.
AB CARBOGEL WISHES TO ASSIST NBEPC IN THE RESOLUTION OF THEIR PROBLEM AND WILL DISCUSS AGAIN WITH CB DEVCO, BUT MY PARAS CCC. AND DDD. ABOVE IS THE PRINCIPLE OF THE MATTER.

BEST REGARDS

ERIC J. THOMAS

72841 CARBOG S
NBEPC PSDO FRN

* WHY SHOULD. ERIC THOMAS THINK THIS. AFTER HE HAD BEEN TOLD C.B.D.C DID NOT HAVE ANY CHEMICALS IN STOCK ?

NBEPC PSDO FRN

DEVCO GLBY

10/

NO: 0098   11/14/85   13:49

File: [illegible]
C[illegible] Development
Date:

ATTN: MR. D.M. RANKIN

SUBJECT: SETTLED CWF AT CHATHAM

THIS TLX IS BEING RELAYED FROM PITTSBURGH.

A
-

ESTIMATED DELY TIME FOR C13 TO CHATHAM FOLLOWING RECEIPT OF A SUITABLE P.O. TO COVER BOTH CBDC SERVICE AND CHEMICALS IS 72 HOURS.
DELIVERED C13 PRICE IS 3.05 PER KILOGRAM (CAD).

B
-

OUR DETAILED ANALYSIS OF SETTLED CHATHAM CWF SAMPLES INDICATES THAT THERE IS MORE TECHNOLOGY REQUIRED THAN ADDITION OF C13.

C
-

NO CHEMICAL WILL BE SHIPPED TO CHATHAM WITHOUT CBDC TECHNICAL PERSONNEL TO SUPERVISE THE ADMINISTERING OF THE TECHNOLOGY.

D
-

CBDC HAVE BEEN SUCCESSFUL IN RETURNING SETTLED CHATHAM CWF SAMPLES TO FLUID STATE IN OUR LABORATORY. ADEQUATE MIXING WILL BE REQUIRED IN YOUR RAILCAR AND ~~BUNDER~~ TO ENSURE CHEMICAL IS THOROUGHLY BLENDED WITH SETTLED COAL. OTHERWISE, LARGE DEPOSITS OF SETTLED COAL WILL REMAIN.

E
-

CBDC REMAIN ON STANDBY AND READY TO ASSIST NBEPC IN RESOLVING THEIR PROBLEM WITH SETTLED CWF.

REGARDS
ADRIAN WHITE

CORRECTION UNDER B D LINE 3 SHOULD READ BUNKER NOT BUNDER

NBEPC PSDO FRN

11

File: [illegible]4 Chatham
Coal/Water Burner Development
NRC TEST - FUEL
Date: 15 Nov 85

001
019351324
DEVCO GLBY
4
DEVCO GLBY

NBEPC PSDO FRN

NOV. 15/85
DEVCO, CBDC
SYDNEY, NS

ATTN: ADRIAN WHITE
DIR. OF PROCESS TECH.

SUBJ: ADDITIVES FOR CARBOGEL FUEL AT THE CHATHAM PLANT AND CBDC LABOUR

ORDER NO.: 730-597

PLEASE SUPPLY THE FOLLOWING ITEMS

A). ONE HUNDRED KILOGRAM DRUM OF C-13 AT A COST OF DLR 3.05 (CANADIAN) PER KILOGRAM, DELIVERED TO NB POWER'S CHATHAM PLANT CHATHAM, N.B.

DELIVERY, 72 HOURS FROM RECEIPT OF THIS ORDER.

B) CBDC LABORATORY PERSONNEL TO ASSIST NB POWER'S STAFF IN THE CORRECTION OF THE CBDC CARBOGEL FUEL NOW AT NB POWER'S CHATHAM STATION.

TOTAL LABOUR COST, INCLUDING TRAVEL AND LIVING EXPENSES NOT TO EXCEED A MAXIMUM OF DLR 2,500.00 (CANADIAN)

NAMES AND EXPERIENCE OF THE PERSONNEL CBDC IS PROPOSING TO SEND TO THE CHATHAM PLANT ARE TO BE SUBMITTED TO NB POWER, IN ADVANCE, FOR APPROVAL.

PLEASE ADVICE THE CHATHAM PLANT THE DATES AND EXPECTED TIME OF ARRIVAL AT THE CHATHAM PLANT, OF CBDC PERSONNEL BEFORE THEY LEAVE SYDNEY.

REGARDS
JOE YOUNG
NBEPC
CHATHAM PLANT
J4
DEVCO GLBY

NBEPC PSDO FRN

12

File: CWF 4 ...
C[illegible] Development
NRC TEST- FUEL
18 Nov 85

NBEPC PSDO FRN

DEVCO GLBY

NO: 0137   11/18/85   09:49

URGENT · URGENT

PLS RELAY MESSAGE TO MR. JOE YOUNG AT CHATHAM PLANT IMMEDIATELY.

SUBJECT: ORDER NO. 730-597/SETTLED CWF AT NBEPC CHATHAM STATION

AA CBDC PERSONNEL ARE READY TO DEPART SYDNEY THIS AM (NOV. 18) ENROUTE TO CHATHAM. THEY WILL BE TRAVELLING VIA ROAD WITH REQUIRED LAB EQUIPMENT, CHEMICALS, AND CAN BE ON SITE AM NOV. 19.

BB NAMES OF CBDC PERSONNEL
1. MR. GREG LANDRY - MANAGER QUALITY CONTROL FOR CARBOGEL
   - PROFESSIONAL ENGINEER
2. MR. CYRIL MACNEIL - CARBOGEL QUALITY CONTROL TECHNOLOGIST

BOTH PERSONNEL HAVE EXTENSIVE EXPERIENCE IN CARBOGEL MANUFACTURE AND THE CORRECTION OF QUALITY CONTROL PROBLEMS. THEY ARE FULLY AWARE OF THE REQUIRED TECHNOLOGY, BASED ON COMPLETE ANALYSIS OF YOUR SETTLED CWF, TO CORRECT YOUR PROBLEM.

MR. LANDRY AND MR. MACNEIL ARE ALSO FAMILIAR WITH YOUR CHATHAM PLANT FROM PREVIOUS VISITS AND KNOW THE ON SITE PERSONNEL.

CC RATES

MR. LANDRY - 55.00 (CAD) PER HOUR + EXPENSES
MR. MACNEIL- 30.00 (CAD) PER HOUR + EXPENSES

CBDC INVOICE TO NBEPC WILL ALSO INCLUDE CHEMICALS USED.

CBDC WILL OTIFY NBEPC IF INVOICE MAY EXCEED 2500.00
NBEPC WILL DECIDE IF ALL WORK STOPS WHEN 2500.00 IS REACHED
OR IF INVOICE IS TO BE AMENDED.

DD OBJECTIVE OF CBDC PERSONNEL WILL BE TO RESLURRY SETTLED CWF SO NBEPC CAN BURN AND DISPOSE. THIS WILL BE DONE BY ADVISING NBEPC STAFF.

EE CBDC WILL BE ON SITE AT CHATHAM WHEN TECHNOLOGY AND CHEMICALS ARE BEING ADMINISTERED. CHEMICALS WILL NOT BE LEFT AT SITE WITHOUT CBDC PERSONNEL PRESENT.

FF CBDC AWAIT NBEPC APPROVAL, AS REQUESTED IN YOUR TLX, PRIOR TO DEPARTURE OF OUR PERSONNEL TO CHATHAM.

BEST REGARDS
ADRIAN WHITE
019-35132+
NBEPC PSDO FRN

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ENERGIE ELECTRIQUE DU NOUVEAU-BRUNSWICK

13

Chatham Plant
November 19, 1985

Please Refer To Our
File NO: C.W.F. - 4
N.R.C. Test Fuel

Mr. Greg Landry
Q.A. Manager for C.B.D.C.'S
Carbogel Fuel Preparation Plant

Subject: Reports on Work & Methods while Re-working Carbogel Fuel at N. B. Power's Chatham Plant

Would you please supply N. B. Power with the following reports:

1. Method and results of all testing carried out on the Carbogel Fuel at the Chatham Plant.
2. Method used, and procedures followed for re-working the Carbogel fuel.
3. Detail report on yours and Cyril Neil's daily activities while at the Chatham Plant.

These reports will form part of the final project report, and are required before you leave the Chatham Plant.

Yours truly,

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

M. R. Thanisch

M. R. Thanisch
Project Engineering Co-Ordinator

MT:mt

c.c. Dave Rankin, Project Manager
Don MacDonald , Chatham Plant Manager
Jack Flanagan, Chatham Plant
Adrian White, C.B.D.C.

NB 200
1784-1984

14

RECORD OF TELEPHONE CONVERSATION

FILE NUMBER: Chatham CWF #4 NRC Burner

DATE: November 19/85

TIME: 4:00 P.M.

CALL FROM: A. White

FIRM: CBDC

RECEIVED BY: D. Rankin

FIRM: NBP

GENERAL TOPIC OF CONVERSATION:

Re chemicals to rehabilitate fuel CBDC Carbogel

SYNOPSIS OF DISCUSSTION:

1. NB Power questioned the need for two people to advise NBP staff re chemical and process? adrian said G Landry was needed to supervise the technition.
2. NBP advised that they required that the two remaining rail cars be mixed and the chemicals added immediately then CBDC staff can return to base. NB Power will not unload another car until the existing fuel in bunker has been burned.
3. DR advised the fuel in the bunker burns very well on the additives which have been added by NB Power.

D.M. Rankin

15

RECORD OF TELEPHONE CONVERSATION

FILE NUMBER: Chatham CWF #4 NRC Burner

DATE: 20 November, 1985

TIME: 11:00 a.m.

CALL FROM: A. White

FIRM: CBDC

RECEIVED BY: D. Rankin

FIRM: NBP

GENERAL TOPIC OF CONVERSATION:

Re extension of contract for service on stabilizing of fuel PO730-597.

SYNOPSIS OF DISCUSSTION:

1) AW of CBDC advised that their people would not complete their work at Chatham until the end of the week and therefore would exceed the $2500. ceiling for service.

2) DR-NBP advised that NB Power wanted both cars of fuel treated and the ceiling for the service personnel must not be exceeded.

3) AW-CBDC - advise people will return to Sydney tonight, Nov 20/85.

D.M. Rankin

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ENERGIE ELECTRIQUE DU NOUVEAU-BRUNSWICK

16/

Chatham Plant
November 20, 1985

Please Refer To Our
File No: CWF - 4
NRC Test - Fuel

Mr. Greg Landry
Q.A. Manager
CBDC "Carbogel" Fuel
Preparation Plant

Subject: Re: Working of the Two Rail Cars of Coal Water Fuel at N. B. Power's Chatham Plant Supplied by C.B.D.C.

The two rail cars of coal water fuel (CWF) at N. B. Power's Chatham Plant are to be re-worked and brought back to a suitable state so this CWF can be burnt in a satisfactory manner in the Chatham Unit No. 1 Boiler.

This work is to be completed under the terms of our Purchase Order (#730-597) with your company.

Yours truly,

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

M. R. Thanisch

M. R. Thanisch
Project Engineering
Co-Ordinator

MT:mt
c.c. Dave Rankin, Project Engineer
Don MacDonald, Chatham Plant Manager
Jack Flanagan, Chatham Plant
Adrian White, C.B.D.C.

NB 200
1784-1984

17

File: CWF-4
NRC TEST - FUEL
Date 20 NOV 85

NBEPC PSDO FRN

DEVCO GLBY

NO: 0179   11/20/85   15:40

ATTN: MR. DAVE RANKIN

SETTED CWF AT CHATHAM

CBDC HAVE REACHED THE MAX. OF 2500.00 FOR YOUR INVOICE 730-597. IN OUR TELECON OF THIS AM YOU STATED NBEPC DESIRE TO NOT EXCEED 2500.00 ON THIS PO AND NO AMENDMENT WAS DISCUSSED. THIS INFORMATION WAS CONFIRMED BY M. THANISH TO OUR MR. LANDRY.

WE REGRET TO INFORM NBEPC THAT ALL CBDC PERSONNEL AND CHEMICALS ARE NOW ENROUTE TO SYDNEY.

REGARDS
ADRIAN WHITE
019-351324
NBEPC PSDO FRN

18

1985-11-21

File: CWF-3 CHATHAM Coal/Water
Burner Development
NRC Test - Fuel

REPORT ON SITE VISIT

LOCATION: Chatham T.G. Station

SUBJECT: Re-working of the 3 rail cars of settled Carbogel fuel

DATE: November 19 and 20, 1985

PEOPLE MET WITH: Greg Landry
Cyril MacNeil - both from CBDC Carbogel Production Plant

DETAILS:

Tuesday - November 19, 1985

I arrived at the Chatham Plant and found Unit No.1 in-service burning the carbogel fuel the N.B.Power site staff had reworked earlier in the month.

As the NRC people had not arrived, the plant personnel were using the original Forney gun/atomizers.

After lunch, I had a meeting with Greg Landry and Cyril MacNeil, both of CBDC, who had come to the Chatham Plant to assist N.B.Power's site personnel with the reworking of the two remaining cars of CBDC's carbogel fuel (at the Chatham Plant).

The two CBDC people had arrived with no prepared plans on how they were going to proceed with this work - even though these people had been supplied by CBDC to N.B.Power as experts in reworking problem fuel.

The CBDC people brought their 'Rhoemat ' viscosity meter with them but no equipment to actually rework the settled fuel, and had not requested any preparations to be made in advance of their coming to the Chatham Plant.

Initially the CBDC people ~~only~~ wanted to do all the chemical additions to the fuel once it was in the in-plant storage bunker but were told this was impractical for two reasons:

1) N.B.Power could not keep the carbogel in suspension once it had been remixed with air lances, therefore, something had to be added to the fuel while it was still in the rail car, so it could be unloaded.

2) New untreated fuel could not be added to a bunker with reworked fuel already in it.

During their first full day at the Chatham Plant, the CBDC people did some testing on samples of the carbogel fuel, and issued instructions for N.B.Power's nightshift personnel to add B-3 dispersant to the second rail car of remixed carbogel fuel.

But they had:

- no procedures for reworking their settled fuel;
- no plans how the work would be carried out;
- no equipment to rework their fuel;
- no C-13 stabilizer had been supplied to N.B.Power.

Wednesday - November 20, 1985

The CBDC people did some more testing of the fuel and gave N.B.Power a handwritten report but they refused to issue to N.B.Power, any procedures or chemicals for the treatment of either of the remaining two cars containing the settled carbogel fuel (N.B.Power had reworked the first car of fuel earlier in the month).

The CBDC people removed from N.B.Power's Chatham Plant, without obtaining N.B.Power's approval, all the B-3 dispersant which had been at the Chatham Plant since 1983. (N.B.Power did not find out about this until the following day).

The CBDC people left the Chatham Plant because they claimed they had reached the cost ceiling of N.B.Power purchase order with their company. They refused to return to site even when N.B.Power offered to issue then a second P.O. for $800.00 to cover their labour cost to add the C-13 to the second partly treated car of carbogel fuel.

The first car of reworked fuel had been burnt by Wednesday afternoon and as the partly treated car of fuel had remixed quite well, the plant personnel unloaded it on the nightshift.

I left the Chatham Plant Wednesday evening to be able to report all the problems to the Project Manager the following morning.

ld

M. R. Thanisch
Project Engineering Co-ordinator

19/

File: 26/-4
C
NRC TEST - FUEL
Date: 21 NOV 85

0533117‡
EMAR OTT

NBEPC PSDO FRN
NOTE: THIS IS A CORRECTED COPY OF TELEX SENT THIS A.M.

NOV. 21, 1985

TO: A. WHITE

C.C.: DR. P. READ
DR. H. WHALEY

SUBJECT: CBDC CARBOGEL CHATHAM

CONFIRM TODAYS AND RE HABILITATION TELEPHONE CONVERSATION.

PLEASE BE ADVISED THAT:

PURCHASE ORDER NO. 730-597 FOR C13 STABILIZE AND SERVICES SHALL NOT EXCEED A TOTAL VALUE OF DLS. 3,000.00.

PURCHASE ORDER NO. 730-602 IS ISSUED FOR DISPERSANT B3 AND FORMALIN AND TECHNICAL SERVICES AND IS NOT TO EXCEED A TOTAL VALUE OF DLS. 3,000.00

YOURS TRULY,

D.M. RANKIN
N.B. POWERJ‡
EMAR OTT

NBEPC PSDO FRN

20/

22 NOV 85

PHONE CALL FROM : DON MACDONALD
N. B. POWER
CHATHAM PLANT

TO : ADRIAN WHITE
C. B. D. C
SYDNEY N. S.

ISSUING A THIRD PURCHASE ORDER NUMBER TO C.B.D.C TO COMPLETE THEIR WORK AT THE CHATHAM PLANT.

21/

RECORD OF TELEPHONE CONVERSATION

FILE NUMBER: CWF-4 NRC Test - Fuel

DATE: November 25, 1985

TIME: 8:15 a.m.

CALL FROM: Mike Thanisch

FIRM: N.B.Power Fredericton

RECEIVED BY: Don MacDonald

FIRM: N.B.Power Chatham

GENERAL TOPIC OF CONVERSATION:

Rework of C.B.D.C. (Carbogel) Fuel at the Chatham Plant.

SYNOPSIS OF DISCUSSTION:

Don gave me the following report:

1. Greg Landry and Cyril McNeil of C.B.D.C.(Carbogel) left the Chatham Plant at noon on Saturday, November 23, 1985.
2. All the chemicals were put in the third rail car and mixed before it was unloaded.
3. The C.B.D.C. people were having problems mixing the C-13 and were taking over two hours to mix one drum up. The Chatham Plant Chemist (Francine) was able to do the same thing in 15 minutes by using warm water. This further shows CBDC lack of experience and how poorly they were prepared before they came to the Chatham site to re-work their fuel.
4. The third rail car of CWF was unloaded starting on Saturday evening and finished at midday on Sunday.
5. The CWF with a full amount of C-13 in it is not burning as well as the fuel with little or no C-13 in it. The C-13 increased the viscosity to 400+ CPS.
6. Unit No.1 was on-line on Sunday - the opacity was low but the ignitors had to be kept in to maintain stable fires.
7. The fuel with only B-3 (and a small amount, or no C-13) had a viscosity of 250 CPS but had good and stable fires.
8. I asked Don to ensure the operators keep their log up with detailed report, and record all their boiler readings. Also they mark on the opacity chart the time and main events.
9. As yet, Don has not received a report on how empty the rail cars are but judging by the amount of fuel unloaded, there cannot be much left in them.
10. Don has made up a list of his problems with the C.B.D.C. personnel sent to Chatham, which he will forward to Fredericton.

M.R.Thanisch

22

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

INTERNAL CORRESPONDENCE

File: CWF 5 Chatham
Coal/Water Burner Development
NRC TEST - FUEL
Date: 25 Nov 85

CHATHAM PLANT

NOVEMBER 25, 1986

PLEASE REFER TO OUR FILE NUMBER.........................

MEMO TO: DAVE RANKIN

SUBJECT: RE-WORKING OF CARBOGEL FUEL

****

I wish to express some of my concerns as to the committment and attitude of C.B.D.C. during this past week.

As you are aware we had 80 Tons of coal-water fuel in our bunker storage and (2) full rail cars of fuel waiting to be stabilized. The fuel in our storage bunker had approximately ½ the required stabilization chemical added by our lab staff on November 15, 1985.

a) A purchase order, with a $2500 ceiling was issued to C.B.D.C. for supply of chemical and labor to assist in the re-stablization of the two rail cars and storage bunker.

b) Late November 18, C.B.D.C. personnel arrived on site. After analysis of our bunker storage and one rail car, B3 (A Dispersant) was added to the car that had been agitated with air for approximately 20 hours.

c) On November 19th, at approximately 14:00 Hrs, I was notified by Greg Landry, of C.B.D.C., they had reached the $2500 ceiling and were packing to return home.

d) I called Adrian White of C.B.D.C. and offered an additional P.O. with a $800. ceiling to allow for the addition of C13, the stabilization agent to be added in our storage bunker that evening. One rail car was ready to be unloaded after 2 days of agitation, ——— from 12 Nov to 8 A.M. on Nov 19 .

e) Adrian noted he was concerned about being paid the initial $2500., therefore would not accept a further P.O. until the following day. He apparently wanted to be assured by N.B. Power that he would in fact be paid for work already completed. He agreed his people would stay at their motel until contacted the following day.

f) After agreement to issue an additional P.O. on Nov.20, 1985, bringing the approved total to $6000., C.B.D.C. employees returned to site with the chemicals. (It should be noted that they removed at least (3) forty-five gallon drums of B3 from site. This chemical had been received from C.B.D.C. during the fall of 1983.)

h) The third car had now been treated with B3 and agitated. Once again C.B.C.D. notified us the ceiling of $6000. had been reached and without further compensation they would return without adding the C13 for stabilization. (An additional P.O. was issued).

It is my feeling that one C.B.D.C. employee was sufficient and he should only have had to analyze the fuel and leave instructions for our lab personnel.

Don MacDonald

Don MacDonald
Chatham Plant Manager

DM/hm

cc: V.K. Clark
M. Thanisch ✓

DRAFT Copy

1985-11-29

File: CWF-4 NRC Test : Fuel

HISTORY OF RE-WORKING THE THREE RAIL CARS OF CARBOGEL FUEL

Monday - November 4

- First rail car of carbogel fuel was mixed with air lances for eight hours, and the fuel went into suspension quite well.
- A sample of this fuel was sent to CBDC's Carbogel Laboratory at Victoria Junction.

Tuesday - November 5

- The Chatham Plant Chemist reports they were short of fuel additives (C-13) and they had been told by the Carbogel Laboratory (CBDC) they would ship the required C-13 to them in Chatham.
- A sample of their reworked fuel in the Chatham Laboratory settled within 24 hours.
- Adrian White was called to ask him to have the C-13 shipped as quickly as possible. Mr.White said they did not have any fuel additives on hand and N.B.Power should call either Carbogel Inc. in the USA or A.B.Carbogel in Sweden.
- It was too late in the day to call Sweden, so Carbogel Inc. in New Jersey were called and Peter Beck Hussen said they would check their supplies and contact N.B.Power the following morning.

Wednesday - November 6

- Carbogel Inc. reported they did not have sufficient chemicals in New Jersey to be able to help N.B.Power and suggest they should call their manufacturing plant in Elmwood, Tenn. (Stan Bonner).
- Later Adrian White was called to see if CBDC would have at least 50 lb. of C-13 so the Chatham Plant could treat one car (there were 25 lb. in Chatham). In Mr.White's absence, Bob Kazmel was contacted who said he had just returned and would check their supplies.

- Later Mr.Kazmel reported they had 200 lb. of C-13 and would send 50 lb. to the Chatham Plant.

- Eric Thomas of A.B.Carbogel in Sweden was called and asked to arrange to send the Chatham Plant 150 lb. of C-13. Mr.Thomas said he would check their supplies and have someone call N.B.Power the following morning.

- The Chatham Plant were told to go ahead and unload the rail car of remixed fuel as the 50 lb. of C-13 were being shipped by CBDC.

Thursday - November 7

- As a phone call was not received from A.B.Carbogel in Sweden, they were called and we spoke to Lars Gillberg who said he would check into supplying the required chemicals.

- Bob Kazmel called from CBDC to say they would not be sending the C-13 as they required it, and it would take two weeks for CBDC to process a new order. He was told this was rather poor and had put N.B.Power in a bad position as the Chatham Plant had gone ahead and unloaded the rail car of unstable fuel on the strength of his word. He said he was aware of N.B.Power's problem but there was nothing he could do about it.

- Call from Lars Gillberg of A.B.Carbogel in Sweden to report they had a 100 kilogram drum of C-13 ready to ship to N.B.Power. He was given the shipping instructions and told N.B.Power would resolve the financial arrangements later with CBDC in Sydney.

- Helina Matherson of Carbogel Inc. in New Jersey called to say she had been asked by Eric Thomas to call N.B.Power. She was told in the meantime the matter had been resolved and the chemicals were being shipped to N.B.Power from Sweden. She said she did not think they could do this but dispite the time (8:00 p.m. in Sweden) she would call someone over there.

Friday - November 8

- Telex from A.B.Carbogel in Sweden signed by Eric Thomas (Mrs.Matherson had said he was in hospital) reporting they could not supply the chemicals and N.B.Power should work through CBDC in Sydney, Nova Scotia.

- An answer was sent to Mr.Thomas saying N.B.Power had always worked with CBDC and they (CBDC) had advised N.B.Power to contact A.B.Carbogel in Sweden.

Monday - November 11 - Remembrance Day - Holiday

Tuesday - November 12

- CBDC's phones at their Sydney office were out of order.
- Bob Kazmel at Victoria Junction was called and he said he did not know if Adrian White had ordered the C-13 for Chatham but he would check into it.

Wednesday - November 13

- Report from the Chatham Plant that they had developed a boiler leak while bringing the boiler up to temperature and pressure.
- Adrian White was called and in his absence, his assistant, John Campbell, said he did not know anyting about N.B.Power's requirements.
- Therefore, Bob Kazmel was called who reported he had been instructed by Adrian White to send nothing to N.B.Power until he had received a purchase order from them (N.B.Power) for both the C13 and two of their people to go to the Chatham Plant to rework the fuel. He was asked to have Adrian White call N.B.Power.
- Adrian White called from Pittsburgh USA and insisted they would not order the C-13 from Sweden until they received a purchase order from N.B.Power.
- He was told N.B.Power had no objections to issuing an order to CBDC for the supply of the C-13 and, as always, their people were welcome to come to N.B.Power's Chatham Plant to obtain some experience in handling their Carbogel fuel in the field. But there was no way N.B.Power could justify issuing a purchase order to employ their people as experts in reworking fuel in the field as they had never done it. Whereas N.B.Power's own people at the Chatham Plant had done it a number of times over the past two years, with both Carbogel and OX-CE fuels. Mr.White was quite adamant in stating that if N.B.Pwoer did not issue a purchase order for his people, he would not order the C-13 from Sweden.
- Mr.White was told this could be considered 'black-mail' and said we could call it whatever we liked. As an impasse had been reached, the call was transferred to Dave Rankin (the Project Manager). Later Mr.Rankin sent a telex to Adrian White of CBDC requesting a quotation for the supply of 200 pounds of C-13 (stabilizer).

Thursday - November 14

- A telex was received by N.B.Power from Adrian White stating the C-13 would cost $3.05 (Canadian) per kilogram, and it would only be supplied with CBDC technical personnel to supervise the addition of the chemicals.

- As no rates were given for the CBDC technical personnel, it was assumed they would be charged at payroll cost - the same way as N.B.Power is paid for their involvement in these projects.

Friday - November 15

- A purchase order (via telex) was issued by the Chatham Plant Stores to CBDC for the supply of 100 kilograms of C-13 and $2,500.00 for labour (including expenses). This labour estimate was:

Labour (6 mandays) = 50 hours at $30/hour =	$ 1,500.00
Travel (via road) =	500.00
Living Cost (hotel and meals) =	500.00
TOTAL —	$ 2,500.00

- CBDC were asked to submit the names and experience of the people they were proposing to send to Chatham in advance for approval.

Monday - November 18

- Adrian White of CBDC sent a telex to N.B.Power with the names of their personnel they proosed to send to Chatham and their hourly rate. These people left Sydney before receiving N.B.power's approval.

Tuesday - November 19

- The two CBDC people arrived at the Chatham Plant and did some viscosity checks of the fuel with their own equipment, and left instructions for the Chatham Plant personnel on the evening and night shifts to add B-3 (dispersnat) to the second rail car of carbogel fuel.

- Initially the CBDC people wanted to do all their chemical additions in the bunker but they were told this was impractical for three reasons:

One: The N.B. Power site personnel were having problems keeping the carbogel in suspension once it had been remixed, therefore some chemicals were required to keep in suspension while it was being unloaded.

Two: Remixed but untreated fuel could not be put in the bunker with fuel that had been reworked.

Three: The bunker was not available because N.B. Power and NRC were conducting a gun/atomizer test program.

FUEL TREATED BY N.B. POWER, WITH ONLY 1/2 THE REQUIRED C-13 (PER CBD.C.) GAVE UP THE BEST BURNING RESULTS. C.B.D.C. REPORT NOTED THEIR RHEOMAT TEST SHOWED THIS FUEL SLIGHTLY DILATANT

Wednesday - November 20

- In the morning CBDC people claimed they had exceeded the $2800.00 ceiling of the purchase order although they had only been at the Chatham Station for a few hours and had not reworked any of the settled carbogel fuel, or supplied any of the C-13 to N.B. Power. Some viscosity measurements were taken and a handwritten report was given to N.B. Power, also a quantity of B-3 dispersant had been added to the second rail car by N.B. Power's personnel following instruction given by the CBDC people.

- Following a short meeting and a number of phone calls the CBDC were given a letter telling them under the terms of the P.O. they were required to complete the reworking of the second and third rail cars of fuel. N.B. Power had already completed reworking the first car of fuel.

- At noontime Greg Landry spoke by phone to Adrian White of CBDC and when he had finished the phone call he said, "We are all through." When asked if this meant they were leaving he said, "Oh, no! I have just finished my call with Adrian White." When asked if and when they would be leaving Greg answered, "That would depend on when N.B. Power started paying them."

- It was assumed from this short conversation that they would be staying and it was quite a surprise a couple of hours later when Don MacDonald, the Chatham Plant Manager reported the two CBDC people were in the process of leaving the site.

- Another meeting was held with Greg Landry and he was asked in view of the lunchtime conversation that was going on, and was this ~~none~~ more of CBDC's games?

- Greg replied he had a second phone conversation with Adrian White and had been told to leave the site once he calculated they had reached the cost ceiling of the P.O. regardless to how much work had been completed.

- In view of the question regarding CBDC games Greg said he had told Adrian White N.B. Power were most annoyed about being advised by CBDC to contact A.B. Carbogel in Sweden, and after they had spent some time arranging to have the required C-13 stabilizer shipped some one had put a stop to the shipment.

- Greg reported Adrian had said he had told N.B. Power to contact A.B. Carbogel to obtain the C-13 but he did not consider he had sent N.B. Power on a "wild goose chase."

- As Greg had no authority Don MacDonald called Adrian White and offered to issue a second P.O. to CBDC for $800.00. (The Chatham plant are limited as to the amount of a P.O. they can issue from the plant, this was the reason why the value of the first P.O. could not be increased.) This second P.O. would have allowed CBDC people to at least stay at the Chatham plant that evening to add the C-13 stabilizer to the second rail car of remixed fuel which N.B. Power were ready to start unloading. Adrian White refused to accept this second P.O. and his people left the Chatham plant. It was later found they had removed, without obtaining N.B. Power's approval, all the B-3 dispersant which had been at the Chatham Plant since 1983.

- N.B. Power told CBDC all they required from them was the C-13 stabilizer and written instruction on how it should be added to the reworked fuel.

- CBDC said they would not do this as it was their technology.

- N.B. Power told them that a precedent had already been set as all the chemicals had been supplied to N.B. Power in the past and the B-3 dispersant had been added to the second car the previous evening following their instructions when they (CBDC) were absent from the Chatham plant.

- The Chatham personnel unloaded the second car of fuel on the night-shift, while the boiler was shut down.

Thursday - November 21

- In the morning after speaking to Adrian White Dave Rankin sent a telex to CBDC raising the ceiling of the first P.O. to $3,000.00 and issuing a second P.O. for $3,000.00.

- Later in the morning the CBDC people returned to the Chatham plant but did not add the C-13 to the fuel in the storage bunker until late that evening by which time some of the fuel had been burnt. This delay was due in part to the time it took the CBDC people to mix up one drum of the C-13 stabilizer. They took about 2 hours, whereas the Chatham plant chemist could do it in 15 minutes, by using warm water instead of cold.

- In the meantime the Chatham site personnel had been working on remixing the third rail car of fuel and were experiencing problems keeping it in suspension once it had been remixed because there were no chemicals left in it.

Friday - November 22

- The CBDC people again refused to treat any more fuel (the third car that time) and said they were leaving the Chatham site because they calculated the ceiling of the second P.O. had been reached. This was confirmed by Adrian White.

- Don MacDonald had no choice but to use a third P.O. to CBDC to keep their people at the Chatham Plant, so his plant could obtain the required chemicals to be able to stabilize the third and final rail car of fuel.

- CBDC had already been told their payments would be based upon approved time sheets.

Saturday - November 23

- By lunchtime all the chemicals (B-3, C-13 and formalin) had been added, at N.B. Power's insistance, to the fuel while it was still in the third rail car, and the two CBDC people had left the Chatham plant.
- N.B. Power had to obtain the formalin themselves directly from the supplier in Montreal.
- The fuel and chemicals were well mixed in the rail car before it was unloaded.

Prepared by: M.R. Thanisch
Project Engineering
Co-ordinator

I QUESTION THE EXPERTISE OF C.B.D.C. PERSONNEL IN RE-WORKING SETTLED FUEL IN THE FIELD.

a) FUEL WITH 1/2 THE PROPOSED C13 GAVE BEST BURNING RESULTS.

b) OUR CHEMIST WAS ABLE TO MIX C-13 (WITH WARM WATER VERSUS COLD) IN A FRACTION OF THE TIME REQUIRED BY C.B.D.C.

c) THE ADDITION OF C-13 TO OUR BUNKER RATHER THAN TO THE SECOND RAIL CAR, KNOWING THE MIXING ACTION WITHIN OUR BUNKER, WAS IN MY MIND AN ERROR AND NOT THE ACTION OF AN "EXPERT".

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

INTERNAL CORRESPONDENCE

File: CWF 4 [illegible]
C[illegible] Development
NRC TEST FUEL
Date: 25 Nov 85

CHATHAM PLANT

NOVEMBER 25, 1986

PLEASE REFER TO OUR FILE NUMBER..............................

MEMO TO: DAVE RANKIN

SUBJECT: RE-WORKING OF CARBOGEL FUEL

****

I wish to express some of my concerns as to the committment and attitude of C.B.D.C. during this past week.

As you are aware we had 80 Tons of coal-water fuel in our bunker storage and (2) full rail cars of fuel waiting to be stabilized. The fuel in our storage bunker had approximately ½ the required stabilization chemical added by our lab staff on November 15, 1985.

a) A purchase order, with a $2500 ceiling was issued to C.B.D.C. for supply of chemical and labor to assist in the re-stablization of the two rail cars and storage bunker.

b) Late November 18, C.B.D.C. personnel arrived on site. After analysis of our bunker storage and one rail car, B3 (A Dispersant) was added to the car that had been agitated with air for approximately 20 hours.

c) On November 19th, at approximately 14:00 Hrs, I was notified by Greg Landry, of C.B.D.C., they had reached the $2500 ceiling and were packing to return home.

d) I called Adrian White of C.B.D.C. and offered an additional P.O. with a $800. ceiling to allow for the addition of C13, the stabilization agent to be added in our storage bunker that evening. One rail car was ready to be unloaded after 2 days of agitation, ——— from 12 Nov to 8 A.M. on Nov 19 .

e) Adrian noted he was concerned about being paid the initial $2500., therefore would not accept a further P.O. until the following day. He apparently wanted to be assured by N.B. Power that he would in fact be paid for work already completed. He agreed his people would stay at their motel until contacted the following day.

f) After agreement to issue an additional P.O. on Nov.20, 1985, bringing the approved total to $6000., C.B.D.C. employees returned to site with the chemicals. (It should be noted that they removed at least (3) forty-five gallon drums of B3 from site. This chemical had been received from C.B.D.C. during the fall of 1983.)

h) The third car had now been treated with B3 and agitated. Once again C.B.C.D. notified us the ceiling of $6000. had been reached and without further compensation they would return without adding the C13 for stabilization. (An additional P.O. was issued).

It is my feeling that one C.B.D.C. employee was sufficient and he should only have had to analyze the fuel and leave instructions for our lab personnel.

Don MacDonald

Don MacDonald
Chatham Plant Manager

DM/hm

cc: V.K. Clark
M. Thanisch ✓

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THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

INTERNAL CORRESPONDENCE

File: CWF.4 Chatham
C[illegible] Development
NRC TEST - FUEL
Date: 25 Nov 85

CHATHAM PLANT

NOVEMBER 25, 1986

ONLY MARKED-UP COPY

PLEASE REFER TO OUR FILE NUMBER..............................

MEMO TO: DAVE RANKIN

SUBJECT: RE-WORKING OF CARBOGEL FUEL

****

I wish to express some of my concerns as to the committment and attitude of C.B.D.C. during this past week.

As you are aware we had 80 Tons of coal-water fuel in our bunker storage and (2) full rail cars of fuel waiting to be stabilized. The fuel in our storage bunker had approximately ½ the required stabilization chemical added by our lab staff on November 15, 1985.

a) A purchase order, with a $2500 ceiling was issued to C.B.D.C. for supply of chemical and labor to assist in the re-stablization of the two rail cars and storage bunker.

b) Late November 18, C.B.D.C. personnel arrived on site. After analysis of the carbogel fuel in our bunker storage and one rail car, B3 (A Dispersant) was added to the car that had already been agitated with air lances for approximately 20 hours.

c) On November 19th, at approximately 14:00 Hrs, work I was notified by Greg Landry, of C.B.D.C., they had reached the $2500 ceiling and were packing to return home.

d) I called Adrian White of C.B.D.C. and offered an additional P.O. with a $800. ceiling to allow for the addition of C13, the stabilization agent to be added in our storage bunker that evening. {One rail car was ready to be unloaded after (2} days of agitation, ~~including~~ (from 12 Nov to 8 A.M. on Nov 19). a total of

e) Adrian White would not accept the new P.O. because ~~noted~~ he was concerned about being paid the initial $2500., therefore would not accept a further P.O. until the following day. He apparently wanted to be assured by N.B. Power that he would in fact be paid for work already completed. He agreed his people would stay at their motel until contacted the following day.

f) After agreement to issue an additional P.O. on Nov.20, 1985, bringing the approved total to $6000., C.B.D.C. employees returned to site with the chemicals. (It should be noted that they removed at least (3) forty-five gallon drums of B3 from N.B Power's * site. This chemical had been received from C.B.D.C. during the fall of 1983.)

* WITHOUT OBTAINING APPROVAL FROM N.B. POWER

h) The third car had now been treated with B3 and agitated. Once again C.B.C.D. notified us the ceiling of $6000. had been reached and without further compensation they would return without adding the C13 for stabilization. (An additional P.O. was issued).

It is my feeling that one C.B.D.C. employee was sufficient and he should only have had to analyze the fuel and leave instructions for our lab personnel.

Don MacDonald
Don MacDonald
Chatham Plant Manager

DM/hm

cc: V.K. Clark
M. Thanisch ✓

NOTE: IN ITEM B, THE "B-3" WAS ADDED TO THE RAIL CAR DURING THE NIGHT-SHIFT, FOLLOWING INSTRUCTION ISSUED BY C.B.D.C BUT WHILE THEY WERE ABSENT FROM THE CHATHAM PLANT.

N.R.C. BURNER DEMONSTRATION
AT
NB POWER'S CHATHAM T.G. STATION

SECTION 16.7

SITE FUEL REPORTS

File: CWF 4 Chatham
Coal/Water Burner Development
NRC TEST - FUEL
Date: (RECEIVED) 15 JULY 85

REVISED. 8 MARCH 86
- 21 JULY 86

COAL WATER FUEL. REPORT
FOR - 1985/86
CWF (CARBOGEL) FROM
C.B.D.C IN SYDNEY N.S.

File: CWF.S... Chatham
Coal/Water Burner Development
NRC TEST BURN - FUEL
Date: 7 MARCH 86

1986

SITE FUEL (CARBOGEL) REPORTS

– SAMPLES TAKEN FROM ROAD TANKER TRUCK

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
FEB 14	1st truck load	1020 @ 12°C	1.18	30.23	TEMP = 12°C } in TRUCK
18	2nd " "	1010 @ 12°C	1.18	30.20	TEMP = 12°C
FEB 20	3rd " "	—	—	—	
FEB 28	4th " "	850 @ 16°C	1.19	30.39	temp = 14°C
MARCH 4	5th " "	800 @ 15°C	1.18	30.02	

– SAMPLES TAKEN FROM STORAGE BUNKER

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
FEB 18	BUNKER	750 @ 21°C	1.12	30.66	AFTER THEY UNLOADED 2nd tank CAR.
" 21	"	660 cps @ 24	1.12	30.50	unloaded 3rd shipment
MARCH 3	"	600 @ 22°C	1.16	29.89	4th truck Load Unloaded
4	"	600 @ 24°C	1.17	30.52	
5	"	500 @ 24°C	1.18	30.58%	
6	"	500 @ 22°C	1.18	30.44	
	ALL BUNKER SAMPLE COLLECTED @ BURNER FRONT				

– SAMPLES TAKEN AT UNIT No1 BUNER FRONT

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
FEB 19	Burner front	740 @ 23°C	1.12	30.58	10^{30} hrs.
FEB 21	" "	660 @ 24°C	1.12	30.60	13^{30} hrs. } Burning Cn-gel from 4-12 shift
FEB 24	" "	550 @ 24°C	1.18	30.00	13^{30} hrs
25	" "	400 @ 25°C	1.18	30.56	11^{30}
"	" "	400 @ 24°C	1.18	30.80	14^{00} hrs. 39 tons left will do test with this fuel
"	" "	390 @ 26°C	1.16	30.14	FOR ALL 3 tests.
MARCH 5th	" "	500 cps @ 24°C	1.18	30.58	tons + 30 tons + 15 tons 4th + 5th + left in bunker 79 tons.
6th		500 @ 22°C	1.18	30.44	"FOR BAG HOUSE" TEST
7th		400 @ 24°C	1.18	30.32	all burned @ 13^{00} hrs

"CARBOGEL" C.W.F. SAMPLES
TAKEN FROM RAIL TANK
CARS IN 1985 -

TANK CARS	CALLIN	RECEIVED	UNLOAD	GONE	SPECIFI.
#23171	—	APRIL 25th*	MAY 2nd		
#23126		APRIL 25	MAY 3rd & 4th.		
#23104		APRIL 25	MAY 10th	MAY 15th	With ic appro left in
#23171		JULY 3rd.	NOVEMBER 6th. UNLOAD	DEC 4	Almx; [illegible] [illegible]
#23126		JULY 3rd	NOV 20	DEC 4	
#23104		JULY 3rd.	NOV 23	DEC 4	

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

COMPLETE ANALYSIS FOR COAL WATER MIXTURE

DATE	85-04-26	85-04-26	85-04-26	85-07-03	85-07-03	85-07-03	
TIME	1st Delivery	1st Delivery	1st delivery	2nd DELIVERY	2nd DEL	2nd DEL	
SAMPLE #	D1	D2	D3	D4	D5	D6	
	23171	23126	23104	23126	23104	23171	

FUEL ANALYSIS

VISCOSITY cps	885 @ 20°C	885 @ 20°C	900 @ 17°C	780 @ 27°C	790 @ 27°C	827 @ 27°C	
TEMPERATURE °C	15°C	15°C	12°C	22°C	24°C	22°C	
SPECIFIC GRAVITY	1.18	1.18	1.18	1.18	1.18	1.18	
MOISTURE %	29.26	29.66	29.91	29.96	29.95	30.29	
ASH %	2.00	2.00	2.00	2.00	2.01	2.00	
VOLATILE MATTER %	38.26	36.36	37.78	38.00	39.50	40.50	
FIXED CARBON %	30.48	31.99	30.31	30.04	28.54	27.21	
GROSS CAL.VAL.BTU/LB DRY BASIS				14134.88	14538.00	14434.47	
GROSS CAL.VAL.BTU/LB AS RECEIVED				9900.07	10183.87	10062.27	
SULPHUR %				1.10	1.09	1.08	

FLY ASH

MOISTURE %							
UNBURNT CARBON %							

BOTTOM ASH

MOISTURE %							
UNBURNT CARBON %							

Analyst By. ANDY HAYWAR

DATE	CAR NO. & SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
April 26	23171	885 cps @ 20°C	1.18	29.26	CAR TEMP = 15°C
26	23126	885 @ 20°C	1.18	29.66	15°C
26	23104	900 @ 17°C	1.18	29.91	12°C may 2/3 1/10th unloading
JULY 3rd	23126	780 @ 27°C	1.18	29.96	temp in car 22°C
"	23104	790 @ 27°C	1.18	29.95	24°C
"	23171	921 @ 27	1.17	29.44	22°C
JULY 8	23171	833 @ 24°C	1.18	30.29	23°C must have had a bad samples.
JULY 10	23126	777 @ 24°C	1.18	30.53	24°C
"	23104	783 @ 23°C	1.18	30.39	23°C
JULY 15	23126	797 @ 25°C	1.18	30.02	23°C
"	23104	783 @ 24°C	1.18	29.61	23°C
"	23171	810 @ 28°C	1.17	30.36	24°C
JULY 24	23126	787 @ 25°C	1.18	29.98	
"	23104	883 @ 25°C	1.18	30.22	
"	23171	920 @ 25°C	1.18	30.04	
AUG 7	23126	770 @ 28°C	1.18	30.92	
"	23104	790 @ 28°C	1.18	30.18	
"	23171	753 @ 27°C	1.18	30.99	

DATE	CAR NO. & SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
Aug 19	23~~1[illegible]~~ 126	743 @ 27°c	1.17	30.30	temp tank car = 24°c
"	23104	663 @ 29°c	1.17	29.89	24°c
"	23171	650 @ 25°c	1.16	30.56	25°c
Sept 3rd	23126	600 cps @ 23°C	1.16	30.67	23°C
"	23104				23°C SAMPLE "UNAVAILABLE"
Sept 3	23171	540 @ 23°c	1.16	30.48	23°C
"	"TANK CARS FUEL ARE STILL IN GOOD SUSPENSION"				
Sept 26	23126	510 @ 23°c	1.16	31.76	
Sept 26	23104	310 @ 23°c	1.16	35.74	Sample contain to much water because of water on top of fuel.
Sept 26	23171	350 @ 22°c	1.16	29.10	

these three last sample are all low in viscosity, because water got in sample (when bringing samples up to surface) there is about a one inch of water on top & a bit of heavy fuel @ bottom "temperature of fuel is holding @ 23°c"

Oct 23	23171	SETTLING @ BOTTOM IS LIKE SOFT PACK this tank car was agitated with air on Sept 30			
	23126	HARD PACK @ BOTTOM @ 2'			
	23104	SOFT PACK ON TOP OF THAT ~~SOFT~~ HARD PACK.			

DATE	CAR NO. OR SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
NOV 4	23171	400 cps @ 12°	1.18	31.12	sample settled over 24hrs. train being agitated.
NOV 15	23126	inspected cars - settling is very hard			
	23104	even after 2hours of agitation sample @ top is still 37.85% water.			
NOV 19	G. Landry & C. McNeil ARE HERE TO ASSIST US				
	in BRINGING FUEL OF TANK & BACK in SUSPENSION				
NOV 20	23126	fuel transferred to t.C. 23171			treated with 40 l of formaldehyde 200 l of B-3.
	23126 unloaded in bunker - C-13 being added to fuel in bunker.				
NOV 22	23104	being air lanced. C-13 being added in			
		tank car. (mixed in solution in truck shop first)			

CARBOGEL C.W.F SAMPLES
TAKEN FROM THE STORAGE
BUNKER IN 1985 -

1985

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
May 6th	BUNKER	885 @ 14°C	1.18	30.04%	TOP
May 7	"	870 @ 16°C	1.18	30.42	
10	"	910 cps @ 20°C	1.18	30.23	
13	"	863 @ 20°C	1.19	30.14	TOP of BUNKER
13	"	988 @ 18°C	1.19	29.07	BOTTOM of BUNKER
14	"	883 @ 19°C	1.19	30.18	TOP
"	"	970 @ ~~19~~ 20°C	1.19	29.16	BOTTOM
15	"	867 @ 20°C	1.19	29.84	TOP
15	"	960 @ 20°C	1.20	28.98	BOTTOM
16	"	810 @ 22°C	1.19	29.83	TOP
16	"	877 @ 23°C	1.20	29.00	BOTTOM
17	"	810 @ 24°C	1.19	29.74	TOP
"	"	890 @ 25°C	1.19	28.94	BOTTOM
21	"	793 @ 22°C	1.19	29.85	TOP
21	"	930 @ 22°C	1.19	28.91	BOTTOM
22	"	793 @ 24°C	1.19	30.14	TOP
"	"	927 @ 24°C	1.19	29.24	BOTTOM
23	"	810 @ 21°C	1.19	29.71	TOP
	"	970 @ 21°C	1.19	28.77	BOTTOM

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
MAY 24	BUNKER	810 @ 22°C	1.19	30.02	TOP
"	"	960 @ 22°C	1.19	29.44	BOTTOM
27.	Bunker	810 @ 22°C	1.19	29.92	TOP.
"	"	957 @ 22°C	1.20	28.90	BOTTOM
28		810 @ 21°C	1.19	29.58	TOP
"		990 @ 21°C	1.19	28.78	BOTTOM
29		843 @ 20°C	1.19	29.66	TOP
"		1013 @ 20°C	1.19	29.07	BOTTOM
30		810 @ 23°C	1.19	30.01	TOP
"		983 @ 23°C	1.19	28.80	BOTTOM
31		803 @ 23°C	1.19	29.54	TOP
"		1020 @ 23°C	1.20	27.68	BOTTOM
June 3rd.		797 @ 24°C	1.19	29.75	11^{45}
"		1110 @ 23°C	1.20	27.51%	BOTTOM
"		1133 @ 23°C	1.20	27.78	12^{35} Hrs.
4		867 @ 23°C	1.19	29.41	TOP
		1090 @ 24°C	1.20	28.27	BOTTOM
5th.		807 @ 24°C	1.19	29.58	TOP
		1123 @ 24°C	1.20	27.32	BOTTOM

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
JUNE 6	BUNKER	803 @ 23°c	1.19	29.31	TOP
	"	813 @ 23°c	1.19	29.55	BOTTOM
JUNE 7	"	810 @ 22°c	1.19	29.70	TOP 9$^{\underline{00}}$
"	"	853 @ 20°c	1.19	29.06	BOTTOM
"	"	847 @ 22°c	1.19	29.91	11$^{\underline{00}}$ TOP
"	"	790 ~~8~~ @ 21°c	1.19	29.68	BOTTOM
10	"	803 @ 23°c	1.19	29.44	TOP
	"	800 @ 23°c	1.19	29.41	BOTTOM
11	"	823 @ 22°c	1.19	30.20	TOP
"	"	740 @ 23°c	1.19	29.19	BOTTOM
"	"	763 @ 22°c	1.19	29.24	a second sample fro bottom do check th low viscosity
12	"	763 @ 23°c	1.19	29.86	TOP
	"	773 @ 23°c	1.19	29.64	BOTTOM
13	"	777 @ 23°c	1.19	30.00	TOP
	"	780 @ 23°c	1.19	29.56	BOTTOM
14	"	763 @ 22°c	1.19	29.98	TOP
	"	776 @ 22°c	1.19	29.78	BOTTOM
17	"	773 @ 24°c	1.19	29.36	TOP
"	"	777 " "	1.19	29.01	BOTTOM

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
June 18	BUNKER	773 @ 24°C	1.19	29.93	8:30 TOP fuel on recircul since last night
"		790 @ 24°C	1.19	29.63	BOTTOM
19	"	717 @ 24°C	1.19	29.77	TOP
"	"	777 @ 23°C	1.19	29.36	BOTTOM
20	"	750 @ 25°C	1.19	30.06	TOP
"	"	777 @ 24°C	1.19	29.84	BOTTOM
21	"	767 @ 24°C	1.19	29.57	TOP
"	"	757 @ 24°C	1.19	29.59	BOTTOM
22	"	760 @ 26°C	1.18	29.56	TOP
"	"	768 @ 26°C	1.18	29.60	BOTTOM
24	"	707 @ 26°C	1.17	29.63	TOP
"	"	727 @ 26°C	1.17	30.34	BOTTOM.
"	"	700 @ 26°C	1.18	29.64	Another sample obtain to verify bottom result
25	"	667 @ 26°C	1.18	30.04	TOP
"	"	733. @ 26°C	1.18	30.36	BOTTOM
26	"	670 @ 25°C	1.18	30.16	TOP
"	"	737 @ 24°C	1.18	29.55	BOTTOM
27	"	613 @ 23°C	1.18	30.74	TOP
"	"	783 @ 22°C	1.18	29.70	BOTTOM

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
JUNE 28	BUNKER	700 @ 24°C	1.18	30.38	TOP
	"	730 @ 22°C	1.19	29.70	BOTTOM
JULY 2nd	"	763 @ 26°C	1.18	30.64	TOP
	"	670 @ ~~47~~ 26°C	1.19	29.41	BOTTOM
	"	707 @ 26°C	1.17	29.92	another sample from bottom to compare w previous one
3rd	"	740 @ 25°C	1.17	29.43	TOP
"	"	780 @ 24°C	1.18	29.65	BOTTOM
4th	"	683 @ 26°C	1.17	29.64	TOP
"	"	657 @ 26°C	1.18	30.20	BOTTOM
8	"	613 @ 25°C	1.15	30.41	TOP
"	"	633 @ 25°C	1.17	30.23	BOTTOM
9	"	633 @ 25°C	1.16	30.21	TOP
"	"	630 @ 24°C	1.18	29.71	BOTTOM
10	"	613 @ 25°C	1.17	29.42	TOP
"	"	617 @ 25°C	1.17	29.09	BOTTOM
11	"	587 @ 25°C	1.15	29.80	TOP
"	"	587 @ 25°C	1.15	29.58	BOTTOM
12	"	600 @ 24°C	1.16	30.21	TOP
"		657 @ 23°C	1.18	30.06	BOTTOM

X

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
JULY 15	BUNKER	567 @ 26°C	1.16	30.14	
	"	590 @ 24°C	1.17	29.86	
16	"	520 @ 26°C	1.17	30.40	9^{30}hrs NO AGITATION ALL SINCE 24h TOP
	"	1877 @ 25°C	1.20 ~~1.20~~	23.37	BOTTOM taking c apart to relocate
16	"	487 @ 26°C	1.18	30.15	TOP another sample obtained after
"	"	1367 @ 26°C	1.19	24.40	BOTTOM 2 hours agitation through bubbling system
17	"	463 @ 26°C	1.18	29.88	TOP
"	"	477 @ 26°C	1.18	29.96	BOTTOM
18	"	477 @ 25°C	1.18	29.88	TOP LINE . S N/P → BOTTOM
"	"	760 @ 25°C	1.20	26.11	13^{30} " LINE UNPLU
19	"	477 @ 24°C	1.18	29.25%	
		507 @ 24°C	1.18	29.59	
	C-13 agent	added to bunker →	0.03% added	172.5 tons in bunker fu	in a 3% solutio
19	"	623 @ 26°C	1.18	30.62	14^{30}hrs TOP } AIR AGITA
"	"	606 @ 25°C	1.18	30.21	BOTTOM } FOR MIXING THE CHEMICALS
"	"	633 @ 26°C	1.18	30.32	15^{20}hrs
"	"	623 @ 26°C	1.18	30.12	
22	"	637 @ 27°C	1.18	30.45	
22	"	610 @ 25°C	1.18	30.34	
22	D.M.	added 1½ barrels of formaldehyde to kill bacterial growth in fuel			

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
JULY 23	Bunker.	680 cps @ 24°C	1.17	30.34	TOP 8^20 hrs
"	"	633 cps @ 25°C	1.18	30.71	BOTTOM
24	"	687 @ 26°C	1.18	30.24	
"	"	613 @ 26°C	1.18	30.40	
25	"	620 @ 26°C	1.18	30.24	
	"	620 @ 26°C	1.18	30.04	
26	"	583 @ 28°C	1.18	29.38	
	"	573 @ 28°C	1.18	30.32	RECIRC DOWN TO 1/2 hr/shift for weeke
29	"	650 @ 23°C	1.18	30.22	
		1963 @ 24°C	1.19	23.21	JULY 30th - 04^00 hrs C.W.M. Pumps Started.
30		677 @ 26°C	1.18	30.26	TOP PUMP WAS TURNING BUT
		2260 @ 24°C	1.20	22.54	" NOT PUMPIN BOTTOM
	PUMP BELT is ~~B~~ WORE OUT -	STATOR OF PUMP WORE OUT			AIR BUBLIN FOR 1 HOUR
30	BUNKER	627 @ 27°C	1.18	30.23	BOTTOM.
31	"	690 @ 26°C	1.18	30.39	~~[illegible]~~
"	"	623 @ 26°C	1.18	30.19	
AUGUST 1st	"	627 @ 26°C	1.18	30.74	TOP PUMP IS STILL OUT
"	"	670 @ 25°C	1.19	29.02	OF SERVIC BOTTOM

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
AUGUST 2nd	BUNKER	597 @ 25°C	1.18	30.70	PUMP WILL BE IN SERVICE THIS P.M.
		983 @ 21°C	1.19	27.32	8^{30}
	12^{30} pump was put on (15 min air bubbling prior)				
2nd	BUNKER	1550 @ 24°C	1.20	25.20	14^{45} hrs.
	pump stop pumping it ruined the teflon keys on pully (Doulie) - M.MTCE TO FIX - MEANWHILE .. AIR BUBBLING THROUGH BUNKER				
August 6th	BUNKER	543 @ 28°C	1.17	30.18	TOP PUMP ON RECIRC. ALL WEEK EN
"	"	573 @ 29°C	1.18	30.37	BOTTOM
7th	"	496 @ 31°C	1.18	30.72	TOP
"	"	510 @ 30°C	1.18	31.14 %	BOTTOM
8th	"	473 @ 28°C	1.18	30.70	TOP
	"	467 @ 29°C	1.18	30.57	BOTTOM
9th	"	460 @ 28°C	1.18	30.02	TOP
		477 @ 28°C	1.18	29.96	BOTTOM
12	"	483 @ 27°C	1.18	30.43	TOP ~~Botton~~
		470 @ 26°C	1.18	30.10	BOTTOM

#1 unit being put on line to burn Carbogel fuel remaining in BUNKER

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
August 13	BUNKER	453 @ 24°C	1.18	30.43	TOP
	"	423 @ 23°C	1.18	30.71	BOTTOM
August 14	"	380 @ 26°C	1.18	30.45	TOP
	"	383 @ 26°C	1.18	30.51	BOTTOM
15	"	347 @ 29°C	1.18	30.06	TOP⇔UNAVAIL. BOTTOM
Burned all the fuel in bunker - ADDED WATER IN BUNKER FLUSHED AROUND LOOP → ALL WEEK END THAT WATER WAS RECIRCULATED IN SYSTEM ⇒ THEN DRAIN INTO ASH LAGOON.					
Nov 6th	BUNKER	UNLOADED T.C. 23171 OF CARBOGEL } WE'RE TO BURN 3 TANK CARS THAT WERE LEFT HERE SINCE JULY 3rd			
Nov 7	BUNKER	300 cps @ 20°C	1.16	31.52	#1 B. Front
"	"	450 @ 20°C	1.16	31.26	TOP
Nov 8	"	310 @ 21°C	1.16	33.72	B.F.
"	"	560 @ 21°C	1.16	32.22	TOP
Nov 12	"	250 @ 18°C	1.16	30.90	#1 B.F.
"	"	300 @ 19°C	1.15	31.85	TOP
Nov 14	"	250 @ 20°C	1.16	30.60	#1 B.F.
"	"	200 @ 20°C	1.16	36.05	TOP

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
Nov 15	BUNKER	250@20°C	1.16	31.59	#1 B.F.
"	"	260@20°C	1.16	32.47	TOP
NOV 18	"	280 @20°C	1.17	30.72	#1 B.F.
"	"	260 @20°C	1.17	33.62	TOP

CARBOGEL C.W.F. SAMPLES
TAKEN AT THE UNIT N° 1
BURNER FRONT IN 1985

1985

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
June 18	BURNER FRONT	757 @ 24°C	1.19	30.13 %	
19		747 @ 24°C	1.19	29.85	
20		743 @ 25°C	1.19	29.53	8^{30} hrs
21		750 @ 25°C	1.19	29.71	9^{30}
22		710 @ 27°C	1.17	29.63	8^{30}
24		670 @ 27°C	1.17	29.83	
25		660 @ 26°C	1.18	30.39	9^{15} hrs
26		720 @ 24°C	1.18	29.56	8^{50} hrs
27		730 @ 22°C	1.18	29.73	9^{35} hrs
28		740 @ 22°C	1.18	29.80	8^{50}
June 30		703 @ 27°C	1.18	30.85	11^{30}
July 2nd		697 @ 26°C	1.18	29.61	
3rd		733 @ 24°C	1.17	29.55	8^{30} hrs
4th		687 @ 27°C	1.18	29.97	8^{30}
5th		633 @ 27°C	1.18	29.99	9^{00} hrs
8th		650 @ 25°C	1.17	30.61	9^{00} hrs FUEL ON RECIR
9th		603 @ 25°C	1.18	29.82	
10		597 @ 25°C	1.18	29.39	
11		580 @ 25°C	1.15	29.80	

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
July 12	BURNER FRONT	580 cps @ 24°C	1.18	29.97	FUEL STILL ON RECIR 1/2 hr/Shift
15	"	560 @ 25°C	1.18	29.79	
16	RECIRCULATION PUMP IS OUT OF SERVICE				NO RECIRC IN THE LA. 24 hrs. RELOCATING PUM.
	#1 Burner Front loop has been drained & Flushed out.				
	C.13 & formaldehyde has been added in bunker to keep C.W.M. in SUSPENSION.				
JULY 23	#2 Burner front	563 cps @ 25°C	1.18	30.68	8^{30}
	" " "	627 @ 26°C	1.18	30.57	13^{00} hrs
24	" "	613 @ 26°C	1.18	30.34	
25	" "	547 @ 28°C	1.18	29.86	10^{00} HRS
"	" "	550 cps @ 29°C	1.18	30.31	14^{00} hrs to check previous reading
26	" "	550 @ 29°C	1.18	30.06	
	RECIRCULATION PUMP SCHEDULE TO 1/2 hrs/Shift for week end				
29	1/2 hrs/shift /recirculation @ 04^{00} on July 30 /				put on recircu
30	Burner Front &	587 @ 25°C	1.18	29.86	PUMP NOT WORKING.
AUGUST 2nd	" "	623 @ 24°C	1.18	31.01	14^{45} hrs BEFORE LONG WEEK END
6th	" "	577 @ 29°C	1.18	30.51	has stayed on reci all week end
6th	" "	550 @ 30°C	1.18	30.75%	13^{00} hrs.

DATE	CAR NO. or SAMPLE	VISCOSITY	DENSITY	MOISTURE	REMARKS
AUGUST 7th	Burner front	485 @ 32°c	1.18	31.04	10^{45} hrs
AUGUST 8	" "	470 @ 29°c	1.18	30.35	
9	"	460 @ 28°c	1.18	29.97	
13	"	413 @ 24°C	1.18	30.15	
14	"	427 @ 26°c	1.18	30.21	
15	"	350 @ 29°c	1.18	30.33	Bunker completely burned out
1st delivery = Carbogel	fuel all	burn →	LEFT AT PLANT 3 TANK CARS		
2nd delivery					
OCT 2nd	23171	500 cps @ 25	1.17	30.44	burning directly from tank car with holding tank @ BF. FOR NRC
NOV 18	Burner front	280 @ 20°c	1.17	30.72	
NOV 19	" "	260 @ 20°c	1.17	31.79%	
NOV 22	" "	450 @ 20°c	1.15	31.63	9^{00} hrs
"	" "	750 @ 20°c	1.15	33.20	11^{40} hrs
NOV 23	" "	960 @ 24°c	1.07	35.30	11^{35} hrs
"	" "	860 @ 24°C	1.07	35.18	14^{00} hrs
NOV 24	" "	620 @ 18°c	1.17	33.36	
→ FUEL ALL BURNED OUT ←					

N.R.C. BURNER DEMONSTRATION

AT

NB POWER'S CHATHAM T.G. STATION

SECTION 16.8

UNIT NO. 1 BOILER EFFICIENCY TESTS

DATA SHEETS

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
CHATHAM THERMAL GENERATING STATION
UNIT NO. 1 FRONT FIRED BOILER

DATA SHEETS FOR THE NRC/EMR
BAGHOUSE AND BURNER
TEST PROGRAM
FEBRUARY 1986

DATE SHEET NO.	TITLE
1	* DATA REQUIRED FOR CALCULATING BOILER EFFICIENCY
2A-2B	* DATA REQUIRED FOR CALCULATING BOILER EFFICIENCY
3	LOCATION READINGS TO BE RECORDED DURING TEST PROGRAM
4	DATA RECORDED DURING TEST BOILER
5	DATA RECORDED DURING TEST BOILER
6	LOCATION OF BAGHOUSE TEST POINTS
7	BAGHOUSE DATA SHEET

* DATA REQUIRED BY N.B. POWER's - C.T.S. GROUP

GENERATION EFFICIENCY SECTION
PLANT TECHNICAL SERVICES

DATA FORM FOR BOILER EFFICIENCY TEST
(Losses or Input-Output Method)

CHATHAM UNIT NO. 1

TEST NO.	DATE	DURATION
PLANT		BOILER NO.
BOILER MAKE & TYPE		
FUEL USED		

PRESSURES & TEMPERATURES

1	STEAM PRESSURE IN DRUM	PSIA	
2		PSIA	
3			
4			
5			
6			
7	FINAL FEEDWATER PRESSURE	PSIA	
8	STEAM TEMPERATURE AT S.H. OUTLET	°F	
9	MAIN STEAM PRESSURE S.H. OUTLET	PSIA	
10			
11	SLING., WET BULB TEMP.		
12	SLING., DRY BULB TEMP.		
13	FINAL FEEDWATER TEMPERATURE	°F	
14	TEMP. AIR ENTERING STM. COILS(F.D.INLET)	°F	
15	TEMP. GAS LEAVING BOILER	°F	
16	TEMP. GAS LEAVING AIR HEATER	°F	
17	TEMP. AIR ENTERING AIR HEATER	°F	
18	TEMP. AIR LEAVING AIR HEATER	°F	
19	FUEL TEMPERATURE	°F	

ENTHALPYS

20	ENTHALPY OF SUPERHEATED STEAM	BTU/LB	
21			
22			
23			
24	ENTHALPY OF FINAL FEEDWATER	BTU/LB	
25	ENTHALPY OF VAPOUR IN FLUE GAS	BTU/LB	
26	ENTHALPY OF VAPOUR IN COMB. AIR	BTU/LB	
27	ENTHALPY OF LIQUID IN COMB. AIR	BTU/LB	

28	RELATIVE HUMIDITY OF COMB. AIR	%	
29	MOISTURE IN COMB.AIR(PSYCHRO.CHART)	LB/LB	
30	PERCENT COMBUSTIBLES IN FLY ASH	%	
31	PERCENT COMBUSTIBLES IN BOTTOM ASH	%	

ULTIMATE ANALYSIS OF FUEL

	COAL OR OIL	% WT
32	CARBON	
33	HYDROGEN	
34	OXYGEN	
35	NITROGEN	
36	SULPHUR	
37	ASH	
38	MOISTURE	

39	H.H. VALUE OF FUEL(BTU/LB)	

	QUANTITIES	LB/HR
40	FUEL FIRING RATE	
41	MAIN STEAM FLOW	
42		
43		
44		
45		
46		
47	FINAL FEEDWATER FLOW	
48	WEIGHT OF ASH COLLECTED	

	MANUFACTURERS LOSSES	%
49	RADIATION LOSSES	
50	UNACCOUTABLE LOSSES	

	FLUE GAS ANALYSIS	% VOL
51	O_2 BEFORE AIR HEATER	
52	CO_2 BOILER OUTLET	
53	CO BOILER OUTLET	
54	O_2 AFTER AIR HEATER	

SHEET NO. 1

UNIT No.: ____________________

FILE No.: ____________________

TEST : ____________________

DATE : ____________________

LOAD : ____________________

READING BY: ____________________

CHATHAM THERMAL GENERATING STATION

BOILER AND BURNER EFFICIENCY

TEST PROGRAM

TIME						FINAL F.W. TEMP.	MAIN STEAM		VACUUM IN CONDENSER	FINAL FEED-WATER PRESS.
	KWH X_____	SSI X_____	SSA X_____	FW FLOW X_____	STEAM FLOW X_____		TEMP.	PRESS.		
						°F	°F	PSIG	INS-Hg	PSIG
1st HR										
2nd HR										
3rd HR										
4th HR										
AVG										

REMARKS:

SHEET 2A

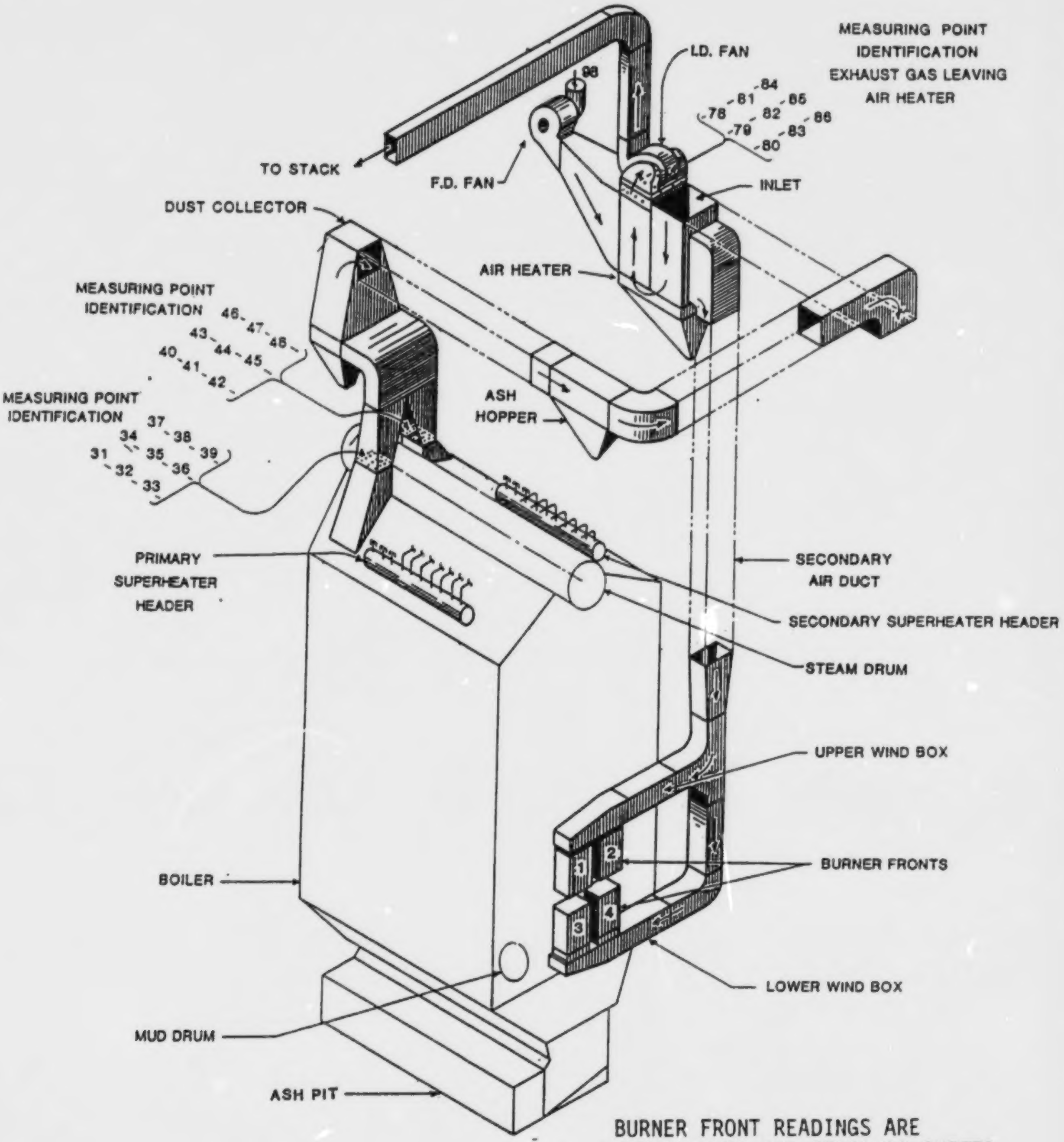
CHATHAM GENERATING STATION

TEST NO. ________ DATE ________ LOAD ________ TIME ________

TIME / PARAMETER								
MAIN STEAM FROM BOILER								
AUX. STEAM FLOW								
MAIN STEAM TO TURBINE								
FEEDWATER FLOW								
OIL FLOW								
AIR FLOW								

SHEET 2B

LOCATION OF READINGS ON THE CHATHAM UNIT NO. 1 FRONT FIRED BOILER FOR THE NRC TEST BURN


MEASURING POINT IDENTIFICATION EXHAUST GAS LEAVING AIR HEATER
84
81
85
78
82
86
79
83
80
I.D. FAN
98
TO STACK
F.D. FAN
INLET
DUST COLLECTOR
AIR HEATER
MEASURING POINT IDENTIFICATION
46
47
48
43
44
45
40
41
42
MEASURING POINT IDENTIFICATION
37
38
34
35
39
31
36
32
33
ASH HOPPER
PRIMARY SUPERHEATER HEADER
SECONDARY AIR DUCT
SECONDARY SUPERHEATER HEADER
STEAM DRUM
UPPER WIND BOX
1
2
3
4
BURNER FRONTS
BOILER
LOWER WIND BOX
MUD DRUM
ASH PIT

BURNER FRONT READINGS ARE DETAILED ON THE ATTACHED SHEETS

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

BOILER NO. 1

BOILER OPERATOR DATA SHEET

DATA SHEET 1
SHT. 4

% LOAD EFFICIENCY TEST DATE TIME START TEST

READINGS TAKEN BY TIME FINISH TEST

READINGS TO BE TAKEN AT POINTS

TIME

LOCATION OF READINGS	UNITS							
FUEL								
104 HEAVY OIL FLOW TO BURNERS	gph							
105 HEAVY OIL TEMPERATURE TO BURNERS	°F							
5 COAL WATER FLOW TO BURNERS	lbs/hr							
121 COAL WATER FUEL TEMPERATURE	°F							
6 COAL WATER PRESSURE IN BURNER SUPPLY HEADER	psig							
25 FUEL PRESSURE AT BURNER 1 (HEAVY OIL OR COAL-WATER)	psig							
19 FUEL PRESSURE AT BURNER 2 (HEAVY OIL OR COAL-WATER)	psig							
7 FUEL PRESSURE AT BURNER 3 (HEAVY OIL OR COAL-WATER)	psig							
13 FUEL PRESSURE AT BURNER 4 (HEAVY OIL OR COAL-WATER)	psig							
26 PRESSURE AT BURNER 1 - ATOMIZING (AIR OR STEAM)	psig							
20 PRESSURE AT BURNER 2 - ATOMIZING (AIR OR STEAM)	psig							
8 PRESSURE AT BURNER 3 - ATOMIZING (AIR OR STEAM)	psig							
14 PRESSURE AT BURNER 4 - ATOMIZING (AIR OR STEAM)	psig							
COMBUSTION AIR & GAS								
97 COMBUSTION AIR FLOW	lbs/hr							
98 COMBUSTION AIR TEMPERATURE (BEFORE AIR HEATER)	°F							
COMBUSTION CO_2								
F.D. FAN DISCHARGE PRESSURE	INCHES OF WATER							
SECONDARY AIR PRESSURE AT A.H. OUTLET	INCHES OF WATER							
FURNACE DRAFT PRESSURE	INCHES OF WATER							
DUST COLLECTOR OUTLET DRAFT PRESSURE	INCHES OF WATER							
A.H. OUTLET DRAFT PRESSURE	INCHES OF WATER							
GAS TEMPERATURE ENTERING AIR HEATER	°F							
GAS TEMPERATURE LEAVING AIR HEATER	°F							
SECONDARY AIR TEMPERATURE	°F							
PRIMARY AIR TEMPERATURE	°F							
F.D. AIR CONTROL PRESSURE	INCHES OF WATER							
I.D. AIR CONTROL PRESSURE	INCHES OF WATER							
MASTER CONTROL PRESSURE	INCHES OF WATER							
BOILER DAMPER POSITION								
#1 BURNER BOX PRESSURE	INCHES OF WATER							
#2 BURNER BOX PRESSURE	INCHES OF WATER							
#3 BURNER BOX PRESSURE	INCHES OF WATER							
#4 BURNER BOX PRESSURE	INCHES OF WATER							
BOILER UPTAKE	INCHES OF WATER							
S.H. DAMPER POSITION								
BOILER FEED WATER								
55 PRESSURE	psig							
56 FLOW	lbs/hr							
57 TEMPERATURE	°F							
AIR CONTROL PRESSURE	psig							
BOILER STEAM								
51 DRUM PRESSURE	psig							
52 STEAM TEMPERATURE	°F							
53 STEAM HEADER PRESSURE	psig							
54 STEAM FLOW	lb/hr							
COMPRESSED AIR								
SUPPLY AIR PRESSURE	psig							
120 SUPPLY AIR FLOW	SCFM							
FUEL								
74 LEVEL OF COAL WATER FUEL IN BUNKER								
76 COAL WATER PRESSURE ENTERING DUPLEX FILTER								
75 COAL WATER PRESSURE LEAVING DUPLEX FILTER								
COAL WATER FLOW THROUGH PUMP								
119 COAL WATER FLOW RETURNING TO BUNKER								
FURNACE TEMPERATURES AND OXYGEN HEAT FLUX								
108 HEAT FLUX AT BACK OF BOILER TOP RIGHT PORT								
109 HEAT FLUX AT BACK OF BOILER MIDDLE RIGHT PORT								
110 HEAT FLUX AT BACK OF BOILER LOWER RIGHT PORT								
111 HEAT FLUX AT BACK OF BOILER TOP LEFT PORT								
112 HEAT FLUX AT BACK OF BOILER MIDDLE LEFT PORT								
113 HEAT FLUX AT BACK OF BOILER LOWER LEFT PORT								

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

BOILER NO. 1

FIELD DATA SHEET

DATA SHEET 2
SHT. 5

% LOAD EFFICIENCY TEST DATE

TIME START TEST

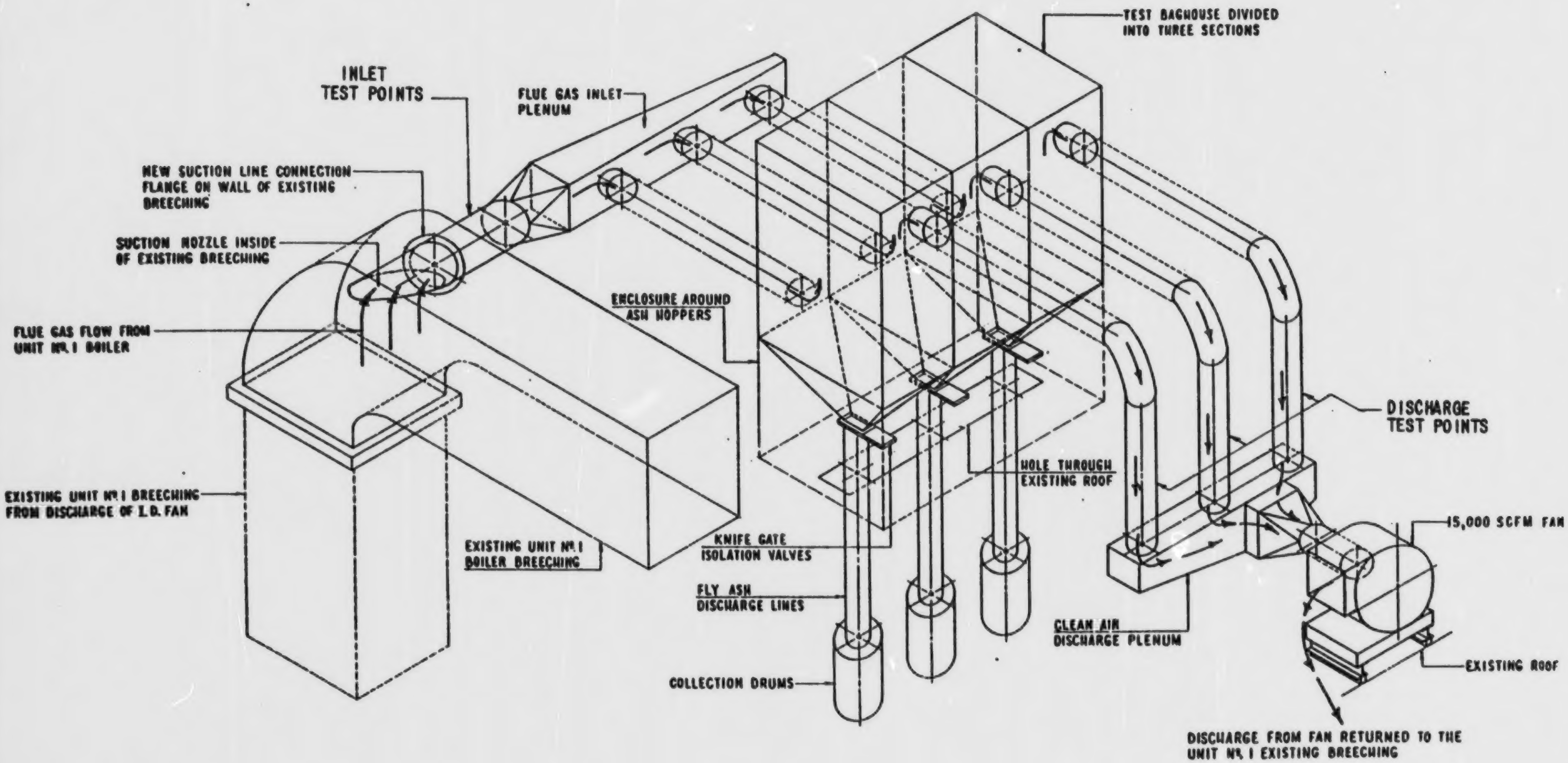
READINGS TAKEN BY

TIME FINISH TEST

READINGS TO BE TAKEN AT POINTS

TIME

LOCATION OF READINGS	UNITS							
COMBUSTION AIR & GAS								
99 STACK NO_x								
100 STACK SO_x								
101 STACK PARTICULATE								
102 STACK OPACITY								
103 STACK CO								
106 STACK CO_2								
107 STACK O_2								
31 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
32 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
33 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
34 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
35 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
36 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
37 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
38 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
39 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) TEMPERATURE	°C							
31 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
32 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
33 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
34 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
35 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
36 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
37 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
38 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
39 BOILER GAS DISCHARGE (PRIMARY S.H. SIDE) OXYGEN	% Vol							
40 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
41 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
42 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
43 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
44 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
45 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
46 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
47 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
48 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) TEMPERATURE	°C							
40 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
41 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
42 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
43 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
44 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
45 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
46 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
47 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
48 BOILER GAS DISCHARGE (SECONDARY S.H. SIDE) OXYGEN	% Vol							
78 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
79 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
80 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
81 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
82 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
83 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
84 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
85 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
86 GAS DISCHARGE FROM AIR HEATER TEMPERATURE	°C							
78 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							
79 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							
80 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							
81 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							
82 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							
83 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							
84 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							
85 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							
86 GAS DISCHARGE FROM AIR HEATER OXYGEN	% Vol							


INLET TEST POINTS
FLUE GAS INLET PLENUM
TEST BAGHOUSE DIVIDED INTO THREE SECTIONS
NEW SUCTION LINE CONNECTION FLANGE ON WALL OF EXISTING BREECHING
SUCTION NOZZLE INSIDE OF EXISTING BREECHING
FLUE GAS FLOW FROM UNIT Nº 1 BOILER
ENCLOSURE AROUND ASH HOPPERS
DISCHARGE TEST POINTS
HOLE THROUGH EXISTING ROOF
EXISTING UNIT Nº 1 BREECHING FROM DISCHARGE OF I.D. FAN
15,000 SCFM FAN
EXISTING UNIT Nº 1 BOILER BREECHING
KNIFE GATE ISOLATION VALVES
FLY ASH DISCHARGE LINES
CLEAN AIR DISCHARGE PLENUM
EXISTING ROOF
COLLECTION DRUMS
DISCHARGE FROM FAN RETURNED TO THE UNIT Nº 1 EXISTING BREECHING

SHEET 6

CHATHAM BAGHOUSE TEST PROGRAM
LOCATION OF TEST POINTS
FEBRUARY - 1986

SHEET). 7

CHATHAM NO. 1 UNIT

BAGHOUSE READINGS

TEST NO.________ DATE ________ LOAD ________ TIME ________

PARAMETER / TIME										
INLET PRESS.										
INLET TEMP.										
INLET FLOW										
A DISCH. PRESS.										
A DISCH. TEMP.										
A DISCH. FLOW										
TIME TO BUILD-UP CAKE										
B DISCH. PRESS.										
B DISCH. TEMP.										
B DISCH. FLOW										
TIME TO BUILD-UP CAKE										
C DISCH. PRESS.										
C DISCH. TEMP.										
C DISCH. FLOW										
TIME TO BUILD-UP CAKE										
A DISCH. COLLECTION										
B DISCH. COLLECTION										
C DISCH. COLLECTION										

N.R.C. BURNER DEMONSTRATION

AT

NB POWER'S CHATHAM T.G. STATION

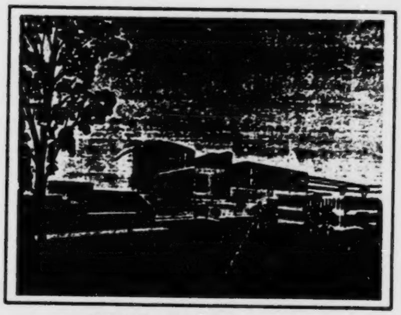
SECTION 16.9

REPORT ON THE
UNIT No. 1 BOILER EFFICIENCY TEST
CONDUCTED ON FEBRUARY 25/86

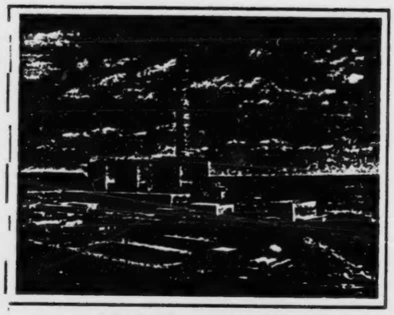
File: CWF.4... Chatham
Coal/Water Burner Development
NRC TEST BURN
Date: 10 APRIL 86

ENERGIE NB POWER

PLANT OPERATIONS DIVISIO

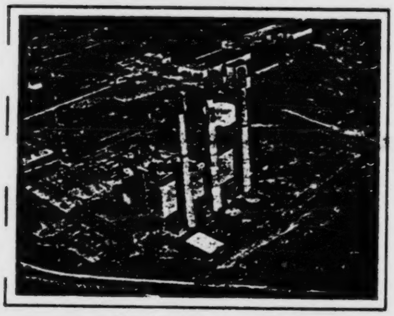


POINT LEPREAU NGS



COLESON COVE GS

DALHOUSIE GS



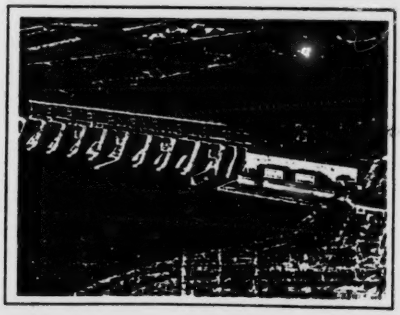
COURTENAY BAY GS

CHATHAM NO 1

BOILER EFFICIENCY

FEB/25/86

REVISED - 10 APRIL 86



Document Name:
CHATHAM BOILER EFFICIENCY TEST

Requestor's ID:
LD

Author's Name:
M.Thanisch

Document Comments:
Chatham No.1 Boiler Test Efficiency (Don Morrison, CTS).

CHATHAM NO.1 BOILER EFFICIENCY TEST

This report documents the results of Central Technical Services (Gen.Eff.Group) testing of the Chatham Unit No.1 Boiler on February 25, 1986.

Three tests were conducted for comparison of combustion and boiler efficiency by the losses method.

Test #1 - (Carbogel with Atomizing Air) Flame conditions on this test were only just acceptable. The fuel to air ratio used was very high to keep the opacity reading down to 39%, and one light oil ignitor had to be left in burner No.4 for combustion support.

Test #2 - (Carbogel with Atomizing Steam) Fires were poor and the air to fuel ratio was even higher on this test than the first test. Burner No.4 required ignitor support. Shortly after the test had been started, No.4 burner was returned to air atomization and the ignitor left in service. The opacity reading was 40% and there were a large number of fireflies and pieces of unburned fuel accumulating in the boiler. The test duration was reduced to 30 minutes because of the poor combustion conditions.

Test #3 - (Oil with Atomizing Steam) Using NRC burners, good fires were obtained. The Operator neglected to reduce air flow. This resulted in twice the required air flow. A boiler efficiency of only 78.16% was obtained. With the correct air flow, the O_2 level would have been 50% lower and the boiler efficiency would have been close to 82%. This compares favorably with previous tests done on oil.

NOTE: The unit loads were quite low, which contributes to lower boiler efficiencies than those previously obtained in earlier test.

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Don Morrison
Central Technical Services

REVISED 1986-04-10

SUMMARY OF TEST RESULTS

CHATHAM UNIT NO.1 BOILER EFFICIENCY TEST

WITH COAL-WATER FUEL (CWF) AND NO.6 FUEL OIL

Test No.	Firing Mode	Test Date	Unit Load MWe	PERCENT LOSSES						Total Boiler Efficiency - %
				Dry Gas	Moisture in Fuel*	Unburnt Comb.	Moisture in Air	Radiation	Unmeas.	
1 **	Carbogel with Air Atomization	Feb.25/86	3.7	8.548	7.237	5.835	0.110	1.000	1.500	75.770
2 ***	Carbogel with Steam Atomization	Feb.25/86	2.6	10.503	7.328	11.277	0.146	1,000	1.500	68.247
3	No.6 Oil with Steam Atomization	Feb.25/86	2.6	12.862	6.151	0.160	0.168	1.000	1.500	78.159

NOTES:

- – Only burners No.1 and No.4 were used because there were only two large NRC guns.

* – Total loss from moisture in fuel plus H_2O from combustion of H_2.

** – A light oil ignitor had to be kept in Burner No.4.

*** – Burner No.4 had to be switched to air atomization with an ignitor.

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DATA FROM

CHATHAM UNIT NO.1 BOILER EFFICIENCY TEST

1986-02-25

	Test 1 Carbogel with Atom.Air	Test 2 Carbogel with Atom.Steam	Test 3 CB Oil with Atom.Steam
TEST DURATION	1 Hour	30 Minutes	1 Hour
Load Gross (MWH)	3.7	*2.6	2.6
BTU	10,194	10,111	18,177
Fuel Flow Lb/Hour	7,100	*4,600	4,218.8
FUEL ANALYSIS			
Carbon - %	56.99	56.72	85.15
Hydrogen - %	3.79	3.82	10.99
Oxygen - %	4.32	4.40	0.8
Nitrogen - %	1.15	1.14	0.38
Moisture - %	31.37	31.69	0
Ash - %	1.46	1.48	0.05
O2 Before AH - %	11.1	12.2	12.9
CO Before AH PPM	74.3	337.7	126
CO2 Before Ah - %	8.27	6.3	5.85
Wet Bulb Temp. °F	63.3	62.3	62.0
Dry Bulb Temp. °F	87	83.0	83.0
BOILER READINGS			
Local AH Gas Inlet °F	523.5	515	519
Local AH Gas Outlet °F	298.4	288	305
Avg.AH Gas in °F	550.4	542.5	519
Avg.AH Gas Out °F	291.4	282.6	305.2
M.S. Press.PSIG	598.6	567.5	585
M.S. Flow PPH	57,667	49,000	50,333
Final F.W. Temp. °F	264.6	231	235.6
Drum Press.PSIG	598.3	567.5	599
Final Feed Press.PSIG	850	855	855
Feed Water Flow PPH	55,000	39,000	51,333
M.S. Temp. °F	768	761.5	747
Gas Ent.AH °F	555	545	542.7
Gas Leaving AH °F	330	313	346.7
AH Air Outlet °F	408.3	397.5	401.7
Air Entering AH °F	109	108	108
Burners in Service	1 and 4	1 and 4	1 and 4
Fuel Temp. °F	77.6 (CWF)	81.5 (CWF)	240 (Oil)
**Opacity Reading - %	39	41	4.6
Relative Humidity Air -%	28	28	30

* Generation and fuel flow for a 1 hour test.

** Actual opacity was reduced by running the Unit No.2 boiler fans.

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REPORT NUMBER: IC/85/185 DATE: March 12, 1986
JOB NUMBER: 082000/001D

File: C.W.F. 5 Chatham
Coal/Water Burner Development
NRC GUN & BAGHOUSE TEST
Date: 12 MARCH 86

(RECEIVED - 17. MARCH 86)

Mr. Michael Thanisch
NBEPC
515 King Street
Fredericton, N. B.
E3B 4X1

Analysis of Chatham Samples
I.C. Codes 85/525 to 85/527

On February 26, 1986 the client delivered two jars labelled "Feb. 25th/86 Test #1 1700-1800 Burner Front (015019) 28° and Test #1 Feb. 25/86 17:00-18:00 Burner Front Sample (094645) 29.5°" respectively, and a jar labelled: :Bunker C Oil Sample" to RPC. He requested that we perform proximate and ultimate analyses as specified.

Results:

I.C. Code	85/525		85/526		85/527
Label	Test #1 (015019) 28°		2 Test #1 (094645) 29.5°		Bunker "C"
	As rec.	100% Dry	As rec.	100% Dry	As rec'd
Moisture (%)	31.37 (d)		31.69 (d)		--
Ash (%)	1.46 (e)	2.15 (d)	1.48 (c)	2.16 (d)	--
H.H.V. (BTU/lb)	10194 (c)	14854 (d)	10111 (c)	14801 (d)	18177
Sulphur (%)	0.92 (c)	1.34 (d)	0.75 (c)	1.10 (d)	2.65
Carbon (%)	56.99 (c)	83.03 (d)	56.72 (c)	83.04 (d)	85.15
Hydrogen (%)	3.79* (c)	5.52 (d)	3.82* (c)	5.59 (d)	10.97
Nitrogen (%)	1.15 (c)	1.67 (d)	1.14 (c)	1.67 (d)	0.38
Oxygen (%) By diff.	4.32* (c)	6.29 (c)	4.40* (c)	6.44 (c)	0.85 (c)

Notes: d = determined value
c = value calculated from results of analysis on dry material
* = these values do NOT take into account the hydrogen and oxygen present in the water of the "as received" fuel.

Derek Kirby
Section Head,
Analytical Services and
Industrial Chemistry

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GENERATION EFFICIENCY SECTION
PLANT TECHNICAL SERVICES

DATA FORM FOR BOILER EFFICIENCY TEST
(Losses or Input-Output Method)

CHATHAM PLANT

TEST NO.	1	DATE	86-02 25
DURATION	1 hr		
PLANT	CHATHAM	BOILER NO.	1
BOILER MAKE & TYPE	F.W.		
FUEL USED	CARBOGELL AND ATOM AIR (1 BURNER L.O. SUPPORT)		

PRESSURES & TEMPERATURES

1	STEAM PRESSURE IN DRUM	PSIA	613.
2			
3			
4			
5			
6			
7	FINAL FEEDWATER PRESSURE	PSIA	864.7
8	STEAM TEMPERATURE AT S.H. OUTLET	°F	728
9	MAIN STEAM PRES S-H. OUTLET	PSIA	613.
10			
11	SLING WET BULB TEMP		63.3
12	SLING DRY BULB TEMP		87.0
13	FINAL FEEDWATER TEMPERATURE	°F	246.6
14	TEMP. AIR ENTERING STM. COILS(F.D.INLET)	°F	184
15	TEMP. GAS LEAVING BOILER	°F	543
16	TEMP. GAS LEAVING AIR HEATER	°F	306.6
17	TEMP. AIR ENTERING AIR HEATER	°F	104
18	TEMP. AIR LEAVING AIR HEATER	°F	408.3
19	FUEL TEMPERATURE	°F	77.6

ENTHALPYS

20	ENTHALPY OF SUPERHEATED STEAM	BTU/LB	1389.1
21			
22	PERCENT COMBUSTABLE IN FLY ASH	%	73.75
23	SPECIFIC HEAT IN FLUE GASS		0.240
24	ENTHALPY OF FINAL FEEDWATER	BTU/LB	216.8
25	ENTHALPY OF VAPOUR IN FLUE GAS	BTU/LB	
26	ENTHALPY OF VAPOUR IN COMB. AIR	BTU/LB	1107.2
27	ENTHALPY OF LIQUID IN COMB. AIR	BTU/LB	73

BURNERS IN SERVICE 1-4

28	RELATIVE HUMIDITY OF COMB. AIR	%	28%
29	MOISTURE IN COMB.AIR(PSYCHRO.CHART)	LB/LB	.007

ULTIMATE ANALYSIS OF FUEL

	COAL OR OIL	% WT
32	CARBON	56.99
33	HYDROGEN	3.79
34	OXYGEN	4.32
35	NITROGEN	1.15
36	SULPHUR	.92
37	ASH	1.46
38	MOISTURE	31.37
39	H.H. VALUE OF FUEL(BTU/LB)	10,194

	QUANTITIES	LB/HR
40	FUEL FIRING RATE	7100
41	MAIN STEAM FLOW	57,667
42		
43		
44		
45		
46		
47	FINAL FEEDWATER FLOW	55,000
48	WEIGHT OF ASH COLLECTED	

	MANUFACTURERS LOSSES	%
49	RADIATION LOSSES	1.0
50	UNACCOUTABLE LOSSES	1.5

	FLUE GAS ANALYSIS	% VOL
51	O_2 BEFORE-A/H	11.1
52	CO_2 BOILER OUTLET	8.27
53	CO BOILER OUTLET	.0074
54	O_2 AFTER-A/H	12.1

GENERATION EFFICIENCY SECTION
PLANT TECHNICAL SERVICES

DATA FORM FOR BOILER EFFICIENCY TEST
(Losses or Input-Output Method)

CHATHAM PLANT

TEST NO. 2 DATE 86-02-25 DURATION 30 MIN

PLANT CHATHAM BOILER NO. 1

BOILER MAKE & TYPE F.W.

FUEL USED CARRDGELL + Atom Steam (Changed 1 CG/A 1 CG/S LO Support)

PRESSURES & TEMPERATURES

1	STEAM PRESSURE IN DRUM	PSIA	582.2
2			
3			
4			
5			
6			
7	FINAL FEEDWATER PRESSURE	PSIA	869.7
8	STEAM TEMPERATURE AT S.H. OUTLET	°F	761.5
9	MAIN STEAM PRES S-H. OUTLET	PSIA	580.2
10			
11	SLING WET BULB TEMP		62.3
12	SLING DRY BULB TEMP		83.0
13	FINAL FEEDWATER TEMPERATURE	°F	231
14	TEMP. AIR ENTERING STM. COILS (F.D. INLET)	°F	104
15	TEMP. GAS LEAVING BOILER	°F	534
16	TEMP. GAS LEAVING AIR HEATER	°F	295
17	TEMP. AIR ENTERING AIR HEATER	°F	104
18	TEMP. AIR LEAVING AIR HEATER	°F	398
19	FUEL TEMPERATURE	°F	81.5

ENTHALPYS

20	ENTHALPY OF SUPERHEATED STEAM	BTU/LB	1380.0
21			
22	Percent Combustable in Fly Ash	%	84.16
23	SPECIFIC HEAT IN FLUE GASS.		0.240
24	ENTHALPY OF FINAL FEEDWATER	BTU/LB	201.1
25	ENTHALPY OF VAPOUR IN FLUE GAS	BTU/LB	
26	ENTHALPY OF VAPOUR IN COMB. AIR	BTU/LB	1106.2
27	ENTHALPY OF LIQUID IN COMB. AIR	BTU/LB	72.8

BURNERS IN SERVICE 1-4

28	RELATIVE HUMIDITY OF COMB. AIR	%	28%
29	MOISTURE IN COMB.AIR(PSYCHRO.CHART)	LB/LB	.0074

ULTIMATE ANALYSIS OF FUEL

	COAL OR OIL	% WT
32	CARBON	56.72
33	HYDROGEN	3.82
34	OXYGEN	4.40
35	NITROGEN	1.14
36	SULPHUR	.75
37	ASH	1.48
38	MOISTURE	31.69
39	H.H. VALUE OF FUEL (BTU/LB)	10,111

	QUANTITIES	LB/HR
40	FUEL FIRING RATE	2300
41	MAIN STEAM FLOW	49,000
42		
43		
44		
45		
46		
47	FINAL FEEDWATER FLOW	39,000
48	WEIGHT OF ASH COLLECTED	

	MANUFACTURERS LOSSES	%
49	RADIATION LOSSES	1.0
50	UNACCOUTABLE LOSSES	1.5

	FLUE GAS ANALYSIS	% VOL
51	O_2 BEFORE. A/H	12.2
52	CO_2 Boiler Outlet	6.3
53	CO Boiler outlet	.0337
54	O_2 AFTER. A/H	13.7

GENERATION EFFICIENCY SECTION
PLANT TECHNICAL SERVICES

DATA FORM FOR BOILER EFFICIENCY TEST
(Losses or Input-Output Method)
CHATHAM PLANT

TEST NO.		DATE 86-02-25	DURATION 1 hr.
PLANT	CHATHAM		BOILER NO. 1
BOILER MAKE & TYPE	FW		
FUEL USED	R.C. OIL		

PRESSURES & TEMPERATURES

1	STEAM PRESSURE IN DRUM	PSIA	612
2			
3			
4			
5			
6			
7	FINAL FEEDWATER PRESSURE	PSIA	870.
8	STEAM TEMPERATURE AT S.H. OUTLET	°F	747.
9	MAIN STEAM PRES S-H. OUTLET	PSIA	600.
10			
11	SLING WET BULB TEMP		62.0
12	SLING DRY BULB TEMP		83.0
13	FINAL FEEDWATER TEMPERATURE	°F	236
14	TEMP. AIR ENTERING STM. COILS(F.D.INLET)	°F	83.0
15	TEMP. GAS LEAVING BOILER	°F	527
16	TEMP. GAS LEAVING AIR HEATER	°F	319
17	TEMP. AIR ENTERING AIR HEATER	°F	104
18	TEMP. AIR LEAVING AIR HEATER	°F	402
19	FUEL TEMPERATURE	°F	240.

ENTHALPYS

20	ENTHALPY OF SUPERHEATED STEAM	BTU/LB	1377.3
21			
22	PERCENT COMBUSTIBLE IN FLY ASH	%	.80
23	SH. IN FLUE GASS		0.242
24	ENTHALPY OF FINAL FEEDWATER	BTU/LB	205.8
25	ENTHALPY OF VAPOUR IN FLUE GAS	BTU/LB	
26	ENTHALPY OF VAPOUR IN COMB. AIR	BTU/LB	1105.1
27	ENTHALPY OF LIQUID IN COMB. AIR	BTU/LB	72.9

BURNERS IN SERVICE 1-4

28	RELATIVE HUMIDITY OF COMB. AIR	%	30%
29	MOISTURE IN COMB.AIR(PSYCHRO.CHART)	LB/LB	.007

ULTIMATE ANALYSIS OF FUEL

	COAL OR OIL	% WT
32	CARBON	85.15
33	HYDROGEN	10.97
34	OXYGEN	.8
35	NITROGEN	.38
36	SULPHUR	2.65
37	ASH	.05
38	MOISTURE	0
39	H.H. VALUE OF FUEL(BTU/LB)	18177.

	QUANTITIES	LB/HR
40	FUEL FIRING RATE	4218.8
41	MAIN STEAM FLOW	50,333
42		
43		
44		
45		
46		
47	FINAL FEEDWATER FLOW	51,333
48	WEIGHT OF ASH COLLECTED	

	MANUFACTURERS LOSSES	%
49	RADIATION LOSSES	1.0
50	UNACCOUTABLE LOSSES	1.5

	FLUE GAS ANALYSIS	% VOL
51	O_2 BEFORE. A/H	12.9
52	CO_2 BOILER OUTLET	5.85
53	CO BOILER OUTLET	.0126
54	O_2 AFTER. A/H	14.5

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              CALCULATION OF BOILER EFFICIENCY
              BY INPUT-OUTPUT AND LOSSES METHOD
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CHATHAM          1  - TEST NO.  1  - LOAD   3.70 M.W.
TEST DATE=25/ 2/3886          TEST TIME=1700/1800

MAIN STEAM TEMPERATURE____________=     768.000 F
MAIN STEAM PRESSURE_______________=     613.000 PSIA
FINAL FEEDWATER TEMPERATURE_______=     246.600 F
FINAL FEEDWATER PRESSURE__________=     864.700 PSIA

           FUEL ANALYSIS DATA
           ------------------

HIGHER HEATING VALUE______________=   10194.000 BTU/LB
FUEL FIRING RATE__________________=    7100.000 LB/HR
% CARBON BY WEIGHT________________=      56.990 %
% HYDROGEN BY WEIGHT______________=       3.790 %
% OXYGEN BY WEIGHT________________=       4.320 %
% NITROGEN BY WEIGHT______________=       1.150 %
% SULPHUR BY WEIGHT_______________=        .920 %
% ASH BY WEIGHT___________________=       1.460 %
% MOISTURE BY WEIGHT______________=      31.370 %

            FLUE GAS ANALYSIS
            -----------------

% OXYGEN BY VOLUME(BEFORE)________=      11.100 %
% OXYGEN BY VOLUME(AFTER)_________=      12.100 %
% CO BY VOLUME(BEFORE)____________=        .007 %
% CO BY VOLUME(AFTER)_CAL.________=        .007 %
% CO2 BY VOLUME(BEFORE)___________=       8.270 %
% CO2 BY VOLUME(AFTER)_CAL._______=       7.435 %
% NITROGEN BY VOLUME______________=      80.459 %
FLUE GAS TEMPERATURE______________=     306.600 F

COMBUSTION AIR TEMPERATURE________=     104.000 F
COMBUSTION AIR MOISTURE CONTENT___=        .007 LB/LB
 WEIGHT OF DRY AIR PER POUND
OF AS FIRED FUEL__________________=      17.459 LB/LB

% COMBUSTIBLES IN DRY REFUSE______=      73.750 %
 WEIGHT OF DRY REFUSE PER POUND
OF AS FIRED FUEL__________________=        .056 LB/LB
 WEIGHT OF CARBON BURNED PER
POUND OF AS-FIRED FUEL____________=        .529 LB/LB
 WEIGHT OF DRY GAS PER POUND
OF AS-FIRED FUEL__________________=      17.690 LB/LB

EXCESS AIR_(BEFORE AIR HEATER)____=     105.411 %

           SUMMARY OF LOSSES
           -----------------

LOSS DUE TO DRY FLUE GAS__________=       8.548 %
LOSS DUE TO MOISTURE IN FUEL______=       3.467 %
LOSS DUE TO H2O FROM COMB. OF H2__=       3.770 %
LOSS DUE TO COMBUST. IN DRY REFUSE=       5.835 %
LOSS DUE TO MOISTURE IN COMB. AIR_=        .110 %
LOSS DUE TO RADIATION_____________=       1.000 %
LOSS DUE TO UNMEASURED LOSSES_____=       1.500 %

BOILER EFFICIENCY(LOSSES)______=          75.770 %
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            CALCULATION OF BOILER EFFICIENCY
            BY INPUT-OUTPUT AND LOSSES METHOD
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CHATHAM          1  - TEST NO.  2  - LOAD   2.60 M.W.
TEST DATE=25/ 2/3886         TEST TIME=1830/1900

MAIN STEAM TEMPERATURE____________=      761.500 F
MAIN STEAM PRESSURE_______________=      580.200 PSIA
FINAL FEEDWATER TEMPERATURE_______=      231.000 F
FINAL FEEDWATER PRESSURE__________=      869.700 PSIA

            FUEL ANALYSIS DATA
            ------------------

HIGHER HEATING VALUE______________=    10111.000 BTU/LB
FUEL FIRING RATE__________________=     4600.000 LB/HR
% CARBON BY WEIGHT________________=       56.720 %
% HYDROGEN BY WEIGHT______________=        3.820 %
% OXYGEN BY WEIGHT________________=        4.400 %
% NITROGEN BY WEIGHT______________=        1.140 %
% SULPHUR BY WEIGHT_______________=         .750 %
% ASH BY WEIGHT___________________=        1.480 %
% MOISTURE BY WEIGHT______________=       31.690 %

            FLUE GAS ANALYSIS
            -----------------

% OXYGEN BY VOLUME(BEFORE) ________=       12.200 %
% OXYGEN BY VOLUME(AFTER)_________=       13.700 %
% CO BY VOLUME(BEFORE) ____________=         .034 %
% CO BY VOLUME(AFTER)_CAL.________=         .028 %
% CO2 BY VOLUME(BEFORE) ___________=        6.300 %
% CO2 BY VOLUME(AFTER)_CAL._______=        5.226 %
% NITROGEN BY VOLUME______________=       81.046 %
FLUE GAS TEMPERATURE______________=      295.000 F

COMBUSTION AIR TEMPERATURE________=      104.000 F
COMBUSTION AIR MOISTURE CONTENT___=         .007 LB/LB
 WEIGHT OF DRY AIR PER POUND
OF AS FIRED FUEL__________________=       22.996 LB/LB

% COMBUSTIBLES IN DRY REFUSE______=       84.160 %
 WEIGHT OF DRY REFUSE PER POUND
OF AS FIRED FUEL__________________=         .093 LB/LB
 WEIGHT OF CARBON BURNED PER
POUND OF AS-FIRED FUEL____________=         .489 LB/LB
 WEIGHT OF DRY GAS PER POUND
OF AS-FIRED FUEL__________________=       22.901 LB/LB

EXCESS AIR_(BEFORE AIR HEATER) ____=      126.040 %

            SUMMARY OF LOSSES
            -----------------

LOSS DUE TO DRY FLUE GAS__________=       10.503 %
LOSS DUE TO MOISTURE IN FUEL______=        3.515 %
LOSS DUE TO H2O FROM COMB. OF H2__=        3.813 %
LOSS DUE TO COMBUST. IN DRY REFUSE=       11.277 %
LOSS DUE TO MOISTURE IN COMB. AIR_=         .146 %
LOSS DUE TO RADIATION_____________=        1.000 %
LOSS DUE TO UNMEASURED LOSSES_____=        1.500 %

BOILER EFFICIENCY(LOSSES) ______=         68.247 %
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                 CALCULATION OF BOILER EFFICIENCY
                 BY INPUT-OUTPUT AND LOSSES METHOD
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     CHATHAM          1  - TEST NO.  3  - LOAD   2.60 M.W.
     TEST DATE=25/ 2/3886          TEST TIME=1930/2030

     MAIN STEAM TEMPERATURE_____________=     747.000 F
     MAIN STEAM PRESSURE________________=     600.000 PSIA
     FINAL FEEDWATER TEMPERATURE________=     236.000 F
     FINAL FEEDWATER PRESSURE___________=     870.000 PSIA

                 FUEL ANALYSIS DATA
                 ------------------

     HIGHER HEATING VALUE_______________=   18177.000 BTU/LB
     FUEL FIRING RATE___________________=    4218.800 LB/HR
     % CARBON BY WEIGHT_________________=      85.150 %
     % HYDROGEN BY WEIGHT_______________=      10.970 %
     % OXYGEN BY WEIGHT_________________=        .800 %
     % NITROGEN BY WEIGHT_______________=        .380 %
     % SULPHUR BY WEIGHT________________=       2.650 %
     % ASH BY WEIGHT____________________=        .050 %
     % MOISTURE BY WEIGHT_______________=       0.000 %

                 FLUE GAS ANALYSIS
                 -----------------

     % OXYGEN BY VOLUME(BEFORE)_________=      12.900 %
     % OXYGEN BY VOLUME(AFTER)__________=      14.500 %
     % CO BY VOLUME(BEFORE)_____________=        .013 %
     % CO BY VOLUME(AFTER)_CAL._________=        .010 %
     % CO2 BY VOLUME(BEFORE)____________=       5.850 %
     % CO2 BY VOLUME(AFTER)_CAL.________=       4.694 %
     % NITROGEN BY VOLUME_______________=      80.795 %
     FLUE GAS TEMPERATURE_______________=     319.000 F

     COMBUSTION AIR TEMPERATURE_________=     104.000 F
     COMBUSTION AIR MOISTURE CONTENT____=        .007 LB/LB
      WEIGHT OF DRY AIR PER POUND
     OF AS FIRED FUEL___________________=      44.803 LB/LB

     % COMBUSTIBLES IN DRY REFUSE_______=      80.000 %
      WEIGHT OF DRY REFUSE PER POUND
     OF AS FIRED FUEL___________________=        .003 LB/LB
      WEIGHT OF CARBON BURNED PER
     POUND OF AS-FIRED FUEL_____________=        .850 LB/LB
      WEIGHT OF DRY GAS PER POUND
     OF AS-FIRED FUEL___________________=      44.652 LB/LB

     EXCESS AIR_(BEFORE AIR HEATER)_____=     144.968 %

                 SUMMARY OF LOSSES
                 -----------------

     LOSS DUE TO DRY FLUE GAS___________=      12.862 %
     LOSS DUE TO MOISTURE IN FUEL_______=       0.000 %
     LOSS DUE TO H2O FROM COMB. OF H2___=       6.151 %
     LOSS DUE TO COMBUST. IN DRY REFUSE=         .160 %
     LOSS DUE TO MOISTURE IN COMB. AIR_=         .168 %
     LOSS DUE TO RADIATION______________=       1.000 %
     LOSS DUE TO UNMEASURED LOSSES______=       1.500 %

     BOILER EFFICIENCY(LOSSES)______=          78.159 %
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NB Power

Combustion Testing of Ceramic Coal-Water (C.W.F.) Atomizers in Unit No.1 Chatham New Brunswick Generating Station

Final Report Baghouse Demonstration

Project Manager

D.M.Rankin,NB Power

The New Brunswick Electric Power Commission

Energy Mines and Resourses Canada

MICROMEDIA

Date July 1986

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Canmet
Scientific
Authority : Dr.H.Whaley

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PILOT BAGHOUSE DEMONSTRATION
AT
N.B. POWER'S CHATHAM T.G. STATION

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Baghouse Demonstration
at
N.B. Power's Chatham T.G. Station

2a - Executive Summary

This program was established to be conducted in parallel with latter part of the N.R.C. burner demonstration to:

- reduce the particulate in the flue gas from the Chatham Plant while the NRC guns and EMR burners were in operation burning coal water fuel (C.W.F.).
- obtain performance data on different fabrics to assist in selection of filter bags for the Charlottetown C.W.F. Demonstration.
- establish a procedure for operating a baghouse when burning:
  - fuel oil
  - fuel oil and CWF
  - CWF
  - and switching between different modes of operation.

In the Fall of 1985 the Charlottetown CWF Demonstration Steering Committee requested N.B. Power to obtain and test a pilot baghouse. The unit was received at the Chatham Plant shortly before Christmas 1985, so installation could not be started until early in the New Year. The baghouse and all auxiliary equipment were installed and ready for operation by mid-February 1986.

The baghouse was operated over a three week period in all modes, burning fuel oil, CWF, and a combination of both.

During this period three sets of bags manufactured from different fabrics were tested. One set of bags failed while operating with flue gas at the temperature for which they had been rated. Pre-coating data, time and rate of fly ash build-up were established for each type of bag. Ash removal methods (cleaning of the bags) were also determined.

After completing the site work samples of each type of bag were subjected to extensive laboratory testing so the performance of each type of fabric could be established. An operating procedure was prepared based upon the results of this demonstration.

Very valuable data was obtained from this demonstration and the particulate level of the flue gas was lowered, which resulted in reduced opacity readings.

This demonstration showed that combined firing of C.W.F. and heavy fuel oil can be handled by a baghouse, and during this short demonstration the Nomex fabric was the better of the three fabrics tested.

Démonstration De Sacs De Filtrage D'Enceinte Close (Baghouse)
À
La Station Thermique De Chatham, Enèrgie N.B.

2b - Sommaire Executif

Ce programme a été etabli pour être mis à l'essai en parallèle avec la plus récente démonstration des brûleurs N.R.C. pour:

- réduire les particules des gaz émanants de la station thermique de Chatham tandis que les fusils à mazout (N.R.C.) et les brûleurs (E.M.R.) étaient en opération brûlant le combustible charbon-eau.
- obtenir les résultats de performance de différents matériaux des sacs à filtrage pour assister dans la sélection des sacs pour la démonstration charbon-eau à Charlottetown.
- établir une procédure pour l'opération de la Baghouse quand on brûle:
  - mazoût
  - mazoût et charbon-eau
  - charbon-eau

  et aussi en changeant les modes d'opération.

A l'automne 1985, le committé de direction de la démonstration charbon-eau à Charlottetown ont fait demande à Energie N.B. d'obtenir et de mettre à l'essai une baghouse. L'unité a éte reçu à la station thermique de Chatham juste avant Noël, 1985. L'installation de la baghouse et l'equipement auxiliaire a commencé au début de l'année 1986 et était prêt pour opération par mi-fevrier, 1986.

La baghouse a été opéré pendant trois semaines dans tous les modes: brûlage de mazoût, de charbon-eau et la combinaison des deux.

Durant cette période, trois ensembles de sacs chaqu'un fabriqué de matériaux différents ont été mis à l'essai. L'un des ensembles de sacs a fait faillite pendant que la température des gaz émanants était la même température que cette ensemble de sacs avait été mis à l'épreuve. L'information de pre-coating, le temps et le taux d'accumulation des cendres ont été établi pour chaque sorte de sac. Les méthodes pour déplacer les cendres (nettoyage des sacs) ont aussi été détèrminé.

Après avoir completé le travail au plant, des échantillons de chaque sorte de sac ont été mis à l'essai au laboratoire pour nous permettre d'évaluer la performance de chaqu'un de ces matériaux. Une procédure d'opération a été préparé basé sur les résultats de cette démonstration.

L'information trés utile a été obtenu de cette démonstration et le niveau des particules des gaz émanants ont été abaissé résultant a une réduction d'opacité.

Cette démonstration a montré que la combustion combiner du combustible charbon-eau avec le combustible mazout lourd peut être conduit en utilisant un collecteur de poussieȓe, et durant cette courte démonstration, le fabric Nomex était le meilleur des trois mis a l'épreuve.

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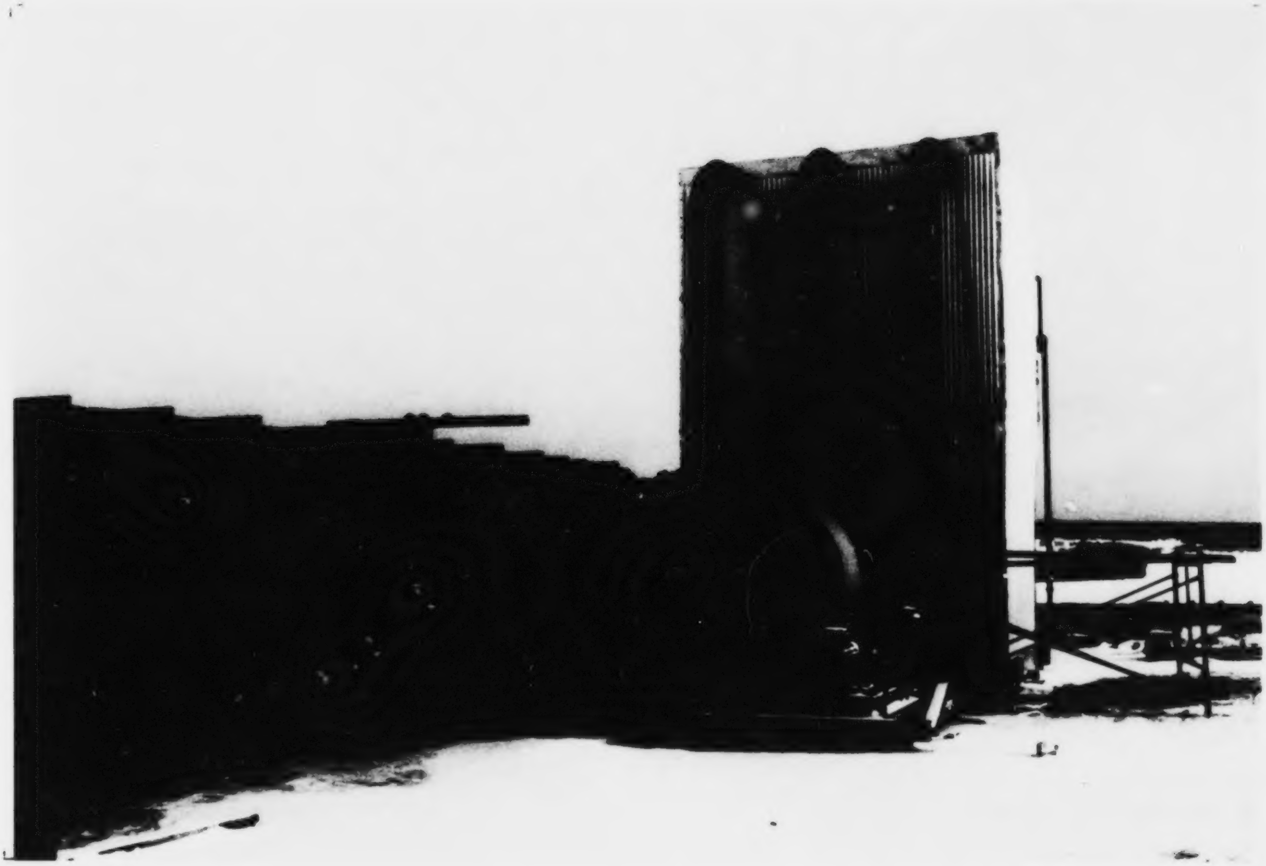

VIEW OF DISCHARGE SIDE
OF THE PILOT BAGHOUSE

SHOWING I.D. FAN AND DUCTING
RETURNING CLEAN FLUE GAS TO THE
UNIT No. 1 BREECHING

FIG. 2.1

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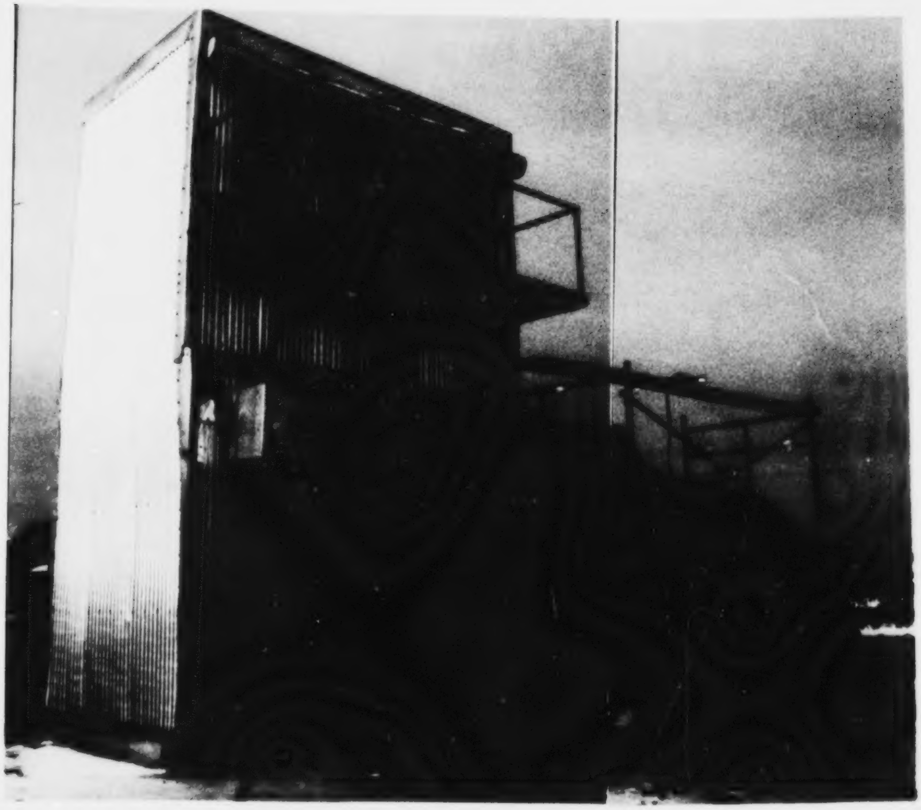


VIEW OF INLET SIDE OF THE PILOT BAGHOUSE

SHOWING CONNECTION WITH THE UNIT No. 1 BREECHING

NOTE : THE SCAFFOLDING WAS REQUIRED FOR ACCESS TO THE INLET PLENUM FOR LIME ADDITION

FIG. 2.2

3.0 INTRODUCTION

The Department of Energy, Mines and Resources has identified coal-water fuels technology development as a priority. The potential for the fuel relates to oil substitution in boilers and furnaces not designed for conventional pulverized coal combustion. Under the special Atlantic Initiatives, funding is being provided to develop burners to burn coal-water fuel and to demonstrate the combustion performance of the fuel in the two utility boilers at Chatham, N.B. In its role of technology support to this demonstration, the Canada Centre for Minerals and Energy Technology (CANMET) has been involved in development of CWF burners through the Chatham Utility Boiler Demonstration Project.

The earlier demonstrations had shown that burner and boiler performance at the present state of development are very dependent on particulate collection, for the removal of fly ash from the flue gas to reduce opacity when burning coal-water fuels. In order to assess the new NRC, CWF burners installed in the Chatham Unit 1 boiler it was the objective of this demonstration to install a pilot baghouse on this boiler. This was to both help reduce the opacity of flue gas from the boiler, and evaluate the performance of the baghouse when burning fuel oil, CWF, or a combination of both.

The data obtained from this demonstration would also be used to assist in the purchase of the baghouse and bags for the Charlottetown CWF demonstration and to develop an operating procedure.

The Charlottetown CWF Demonstration Steering Committee request N.B. Power, in the fall of 1985, to obtain and test a pilot baghouse in conjunction with the NRC burner demonstration.

4.0 BACKGROUND

In April 1982, an agreement was signed between Energy, Mines and Resources, N.B. Power and the Cape Breton Development Corporation which resulted in the construction of a coal-water fuel production plant at Sydney, Nova Scotia. The product from this plant was used for the testing of prototype coal-water fuel burners at N.B. Power's Chatham Generating Station in New Brunswick.

The results achieved from these tests have been encouraging and are supportive of the continued research and development of coal-water fuels as a substitute fuel in existing oil fired boilers.

Coal-water fuel and burner demonstrations are being investigated for oil fired utility boilers up to 100 MWe rating.

From the demonstrations that have been completed to date it has been shown that the high opacity of the flue gas is a major problem when trying to stay within the required environmental standards, therefore this demonstration was requested to investigate dust removal from the fuel gas.

5.0 LIST OF PARTICIPANTS

- New Brunswick Electric Power Commission (provided the Plant)
- CANMET, Energy Research Laboratories, Department of Energy Mines and Resources Canada (the Scientific Authority)
- Cape Breton Development Corporation (coal-water fuel supply)
- National Research Council of Canada (provided burner/atomizers for Unit No. 1 and baghouse filter fabric testing)
- Research and Productivity Council New Brunswick, (baghouse filter bag fabric testing)

6.0 WORK DESCRIPTION

The work plan for this demonstration involved:

- the acquisition of a pilot baghouse and auxiliary equipment
- the installation of:
    - the pilot baghouse
    - I.D. fan for baghouse
    - ash handling system
    - flue gas ducting
    - insulation of the baghouse and ducting
- the development of a test program to cover three types of filter bag fabrics
- operate the baghouse when burning:
    - heavy fuel,
    - CWF,
    - a combination of both fuels,
    - switch between fuels.
- evaluation of the test results and filter bag fabrics.
- the preparation of an operating procedure and recommendation as to the most suitable filter bag fabric.

7.0 SEQUENCE OF EVENTS

DATES	Details of Events
July 1985	Started to look at dust collectors (Baghouse) for the Chatham Plant.
	Preliminary details and prices received from baghouse manufacturers.
Aug. 1985	Telex enquiry sent out to a number companies for a dust collector for the unit No. 1 boiler at Chatham.
	Investigation into obtaining the unused baghouse at Minto, N.B.
Sept. 1985	Investigated reducing the opacity from the front fired boiler, when conducting coal water fuel test, by improving the plume rise from the Boiler House Stack.
Oct. 3/85	Request received from the Charlottetown C.W.F. Demonstration Steering Committee to obtain and install a pilot baghouse on the Chatham Unit No. 1 boiler as soon as possible.
Oct. 7/85	Tenders requested from six suppliers for a pilot baghouse for the Chatham Unit No. 1 boiler.
Oct. 9/85	Dukon Mikropul reported they could not supply a test baghouse at such short notice.
Oct. 10/85	Joy manufacturing reported they could not supply the required baghouse.
	Flakt Canada report they had a small baghouse for rent that would be available for the winter months.
Oct. 28/29	Approval received from members of the Charlottetown Steering Committee to order the test baghouse.
Oct. 29/85	Order sent by Telex to "Air Correction Canada Ltd." for the supply of a; 15,000 scfm baghouse and I.D. fan, including 3 sets of 70 bags, with each set manufactured from a different fabric.

Nov. 13/85 - Project meeting in N.B. Powers' office to plan the baghouse test program for Chatham.

Nov. 14/85 - Sketch of the baghouse received from Air Correction Canada Ltd.

Nov. 21/85 - Preliminary baghouse installation drawings issued to the Chatham Site.

Nov. 26/85 - The baghouse and I.D. fan were completed and loaded for transportation to Chatham, N.B.

Nov. 29/85 - The baghouse and I.D. fan were off-loaded at the Chatham Plant.

Dec. 3/85 - The baghouse and I.D. fan were lifted on to the Chatham Unit No. 1 Boiler House roof.

- Copies of the baghouse and I.D. fan installation drawing were sent to the Chatham Plant.

- A short instruction manual was received from Air Correction Canada Ltd.

Dec. 4/85 - Visit to the Chatham Plant to check on the layout for the baghouse and the orientation of the I.D. fan.

Dec. 6/85 - Copies of the Baghouse and I.D. fan installation drawings were issued for comments to:

  - Air Correction Canada Ltd.
  - CLM Technologies Ltd.
  - Monenco Ltd.

Dec. 9/85 - The Chatham Site reported that they did not have the available manpower to be able to install the baghouse and I.D. fan, and they will be calling tenders from local companies for the installation.

- The static and wind-loadings for the baghouse were received from "Air Correction Canada Ltd".

- A request was made to NB Power's Civil Department to check the Boiler House roof steel to determine if it is adequate to support the baghouse and fans.

Dec. 10/85 - A check list of all the baghouse and fan installation items was sent to the Chatham Plant.

Dec. 12/85 - The internal air (gas) pressure within the baghouse was received from "Air Corection Canada Ltd".

Dec. 16/85 - The Chatham Plant received tenders for installation of the baghouse and I.D. fan, and supply of the ducting, from two companies.

- Rosco Steel Ltd.
- Sunny Corner Mechanical Ltd.

Dec. 17/85 - The Civil Department completed a check of Unit No. 1 building steel and found it to be adequate to support the baghouse and fan.

Dec. 18/85 - Memo received from the Civil Department on the steel.

Dec. 19/85 - Meeting in Fredericton with site engineer of Chatham on the Baghouse and I.D. Fan tenders and installation.

- Meeting with Purchasing on how an order for the Baghouse and I.D. Fan installation could be placed quickly and stay within the requirements of the new Crown Construction Act.

- A memo was written to the purchasing department requesting they make arrangements to have a contractor install the baghouse and I.D. fan.

Dec. 23/85 - Purchasing were was asked if they had received approval to place the order for the Baghouse errection. They in turn asked for copies of the quotation, and later for a purchase order requisition.

Dec. 24/85 - The purchase order requisition was issued and after obtaining the required signatures it was taken to the Purchasing Department.

- An order for the errection of the baghouse and I.D. fan was placed (by phone) with Rosco Steel Ltd.

Dec. 30/85 - A revised copy of the baghouse and I.D. fan errection drawing was issued to the Chatham Plant.

- Site reported they had ordered the required new support steel.

Jan. 6/86 - Preliminary Baghouse Test Program issued for comments.

Jan. 8/86 - The contractor arrived on site to errect the Baghouse.

Jan. 9/86 - Request sent to the baghouse supplier for spare bags.

Jan. 10/86 - Tenders called for insulating of the baghouse, I.D. fan and ducting.

Jan. 15/86 - Quotations received for supply of the baghouse ducting.

Jan. 17/86 - Meeting at NRC office in Ottawa on the Baghouse and NRC Burner Test Programs.

- Errection of the baghouse and installation of the I.D. fan completed.

Jan. 20/86 - Order placed for the manufacture and supply of the baghouse ducting.

- A new crew was employed to work on installing the duct and other items in preparation for the test program.

Jan. 24/86 - N.B. Power's electrical group were requested to look at heating the baghouse hoppers and obtaining a high temperature alarm.

Jan. 27/86 - First sections of the ducting were delivered.

Jan. 31/86 - The contract placed for supply and installation of the insulation.

- MBB and EMR Canmet, were in Chatham to check on the modifications required to the No. 1 burner in the front fired boiler, and all four burner combustion air dampers.

Feb. 4/86 - Installation of the ducting and fly ash discharge lines complete.

Feb. 7/86 - Order placed with C.B.D.C. for the supply and delivery of 180 tonnes of coal water fuel. The fuel was supplied in two batches.

Feb. 10/86 - The insulation contractor started work.

Feb. 10-11/86 - Meeting in Chatham with the Baghouse supplier to check on the installation and operation of the equipment in their supply.

Feb. 13/86 - Arangements made for N.B. Power's test crews to be in Chatham the week of Feb. 18 to 21/86 to conduct efficiency and air quality test.

Feb. 14/86 - Visit to Chatham to ensure everything was ready for the following week's test program.

- The first truck load of new C.W.F. arrived at the Chatham Plant. Problems were experienced with unloading the fuel due to frozen valves on the truck, and a frozen fuel transfer pump in the plant basement.

Feb. 17/86 - No. 1 Burner throat were modified over the weekend, and the combustion air flow control collars installed on the sleeve dampers in all four burners.

- The spare set of filter bags arrived in Chatham and were installed in the third section of the Baghouse.

Feb. 18/86 - When the front fired boiler was brought up to pressure a problem developed with a feed water valve and the unit had to be shut down before any extensive testing could be under taken.

Feb. 19/86 - The Unit No. 1 Boiler was back in service and all day was spent trying to optimumize the NRC coal water fuel gun-atomizers to the new C.W.F.

Feb. 20/86 - Shortly after the turbine had been put into service the vacuum in the condensor was lost and the rest of the day was spent trying to locate the leak in the vacuum system.

- During the day some air flow tests were conducted on the baghouse to establish a datum to judge the baghouse performance once it was put into service.

- In the evening the boiler and turbine were in-service for a short time to assist in locating the vacuum problem, one leak was found and repaired over night.

Feb. 21/86 - Early in the morning the turbine was again put into service but the required vacuum could not be obtained.

- It was late in the day before the problem was finally overcome and the unit was put in service, by this time the efficiency test crew had left the site. (Friday evening).

- In the evening the NRC crew did some more work on optimumizing their gun-atomizers to suit the new C.W.F.

Feb. 22/86 - The unit was out of service on the Saturday to give the crews a rest.

Feb. 23/86 - The NRC and EMR people together with N.B. Power's crew worked to further modify the collars on the combustion air sleeve dampers and to install a new sleeve in the No. 1 burner throat.

Feb. 24/86 - All day was spent trying to improve the fires obtained with the two larger NRC gun-atomizers and the new C.W.F. The problem was the viscosity of the C.W.F. was continuously falling while it was being pumped through the fuel supply and recirculating system.

- By late in the evening it was felt the C.W.F. fires were about as good as could be obtained with the changing fuel, therefore arrangements were made to have the efficiency testing crew return to Chatham the next day.
- The Baghouse was put in service once the Boiler was only burning C.W.F.

Feb. 25/86

- The following three test were conducted:

  1. CWF with air atomization.
  2. CWF with steam atomization.
  3. NRC gun burning Bunker "C" oil with steam atomization,

  The Baghouse was operated for 10 hours.

Feb. 26/86

- As very little CWF was left no more testing could be undertaken until additional CWF had been received.

March 3/86

- Two representatives from EMR and CANMET were at the Chatham Plant to inspect the new Unit No. 1 pilot baghouse.

March 4/86

- Preparation were made to do further testing of the EMR modifications to the no. 1 Burner, and obtaining more operating data for the baghouse.
- The first truck load of the second batch of CWF arrived in Chatham.
- A larger sleeve was installed in the No. 1 burner throat.

March 5/86

- The test program was resumed but the unit could not be put on-line because a seal had failed on the boiler feed pump.
- The seal was repaired and shortly after the unit was on-line it had to be shut down again because of a cooling water leak in the condensor.
- The maintenance crew worked the night shift to repair the condensor leak.

March 6/86

- By mid-morning the unit was on-line.
- No. 1 Burner was in service burning C.W.F. with air atomization, and a good, bright bushy flame was obtained.
- The baghouse was put in service.
- Pressure drop and flow readings were record every half hour for the baghouse.

- Once stable fires had been obtained in the No. 1 burner, efforts were made to improve the CWF flame in burner no. 4.
- Late in the afternoon the No. 1 gun had to be removed because the flame had deteriorated. It was found a piece of rubber (possible from the fuel pump stator) had plugged the atomizer tip. The NRC gun was returned to service and a good stable fire obtained again.
- By this time the No. 1 gun-atomizer had been in service for eight hours with air atomization and no support ignition.
- The atomization medium was changed from air to steam. This was accomplished without any problem.
- At midnight the no. 4 gun burning CWF was removed from service, and the boiler was run overnight with the no. 1 gun burning C.W.F. with steam atomization, and oil guns at part load in burners 2 and 3, to maintain the required heat level in the furnace area of the boiler.

March 7/86

- The no. 1 burner ran all night without any problems burning CWF with steam atomization.
- In the morning the no. 4 burner was returned to service with air atomization.
- Stable fires could not be obtained with the no. 4 burner gun when using steam atomization.
- One set of bags (there were three sets made from different test fabrics) had failed over night, and the section of the baghouse containing these bags was removed from service.
- Both burners no. 1 and no. 4 were kept in service until all the coal water fuel had been consumed.
- No. 1, burner remained stable until the end, where as the no. 4 burner became un-stable as the last of the fuel was burnt.
- At this time the no. 1 burner had been in continuous service for 25.75 hours. 8 hours burning CWF with air atomization, plus 17.75 hours burning CWF with steam atomization without any support ignition. This was the longest time any CWF gun had been run at the Chatham Plant with steam atomization.

- This concluded the on-site testing at the Chatham Plant under this phase of the contract.

March 12/86 - A meeting was held at NRC's office in Ottawa to review the work that been accomplished, and plan future testing.

- Samples of the failed polyester bags were given to NRC for identification and examination.

March 14/86 - A Fiber-glass bag and Nomex bag, (both of which had been in-service) were sent to NRC for examination.

March 18/86 - A used Fiber-glass bag, and used Nomex bag were taken to R.P.C. for testing and examination.

April 8/86 - A report on the testing of the two filter bags was received from R.P.C.

April 10/86 - The boiler efficiency report was received.

April 18/86 - The NRC report on their examination of the three filter bag materials was received.

8.0 DESCRIPTION OF PILOT BAGHOUSE

The baghouse used for the demonstration was obtained to answer a number of questions when burning coal-water fuel, heavy fuel oil or a combination of both. In addition to these operating unknowns, there was both time and cost limitations on this demonstration. For these reasons the baghouse had to meet the following requirements:

- Low cost: - this was achieved by specifying a baghouse that had less capacity than the full load requirements of the boiler, however large enough to reduce the opacity of the flue, and give some meaningful test results on bag performance.

- Short delivery: - The delivery was kept to a minimum by contacting all the known baghouse suppliers to find what their standard sizes of small units were, and the sizes of I.D. (induced draft) fans that were available for immediate (or short) delivery. These two items resulted in a baghouse and I.D. fan being specified that had a capacity of 15,000 cfm, approximately one third the full load flow from the Unit No. 1 boiler, and could be delivered within the required time at a cost that stayed within the budget that was provided for the demonstration.

- The baghouse was designed to be able to answer some of the unknowns, with regard to operating when burning C.W.F. and heavy fuel oil. One of the major concerns was the fabric the filter bags were to be manufactured from. This was addressed by dividing the baghouse into three separate sections, (see figs. 2.1 & 2.2) so that different fabric could be tested simultaneously, under identical conditions. This also allowed the time for the test program to be kept to a minimum, which saved both on operating cost and fuel.

- The baghouse specified had on-line pulse jet cleaning of the filter bags (see figs. 8.1 & 8.2). Each section was specified to have separate controls for air pressure and timing of cleaning, so that each set of filter bags could be supplied with cleaning conditions and air pressures recommended by the filter bag manufacturer.

- To ensure the fly ash, which had been removed from the filter bags did not become cold and consequently set up in the collection hoppers below the baghouse, electrical heaters were attached to the outside surfaces of the hoppers.

- The fly ash collection and removal systems were kept separate from each section of the baghouse so that ash collection from each type of filter bag could be measured and compared.

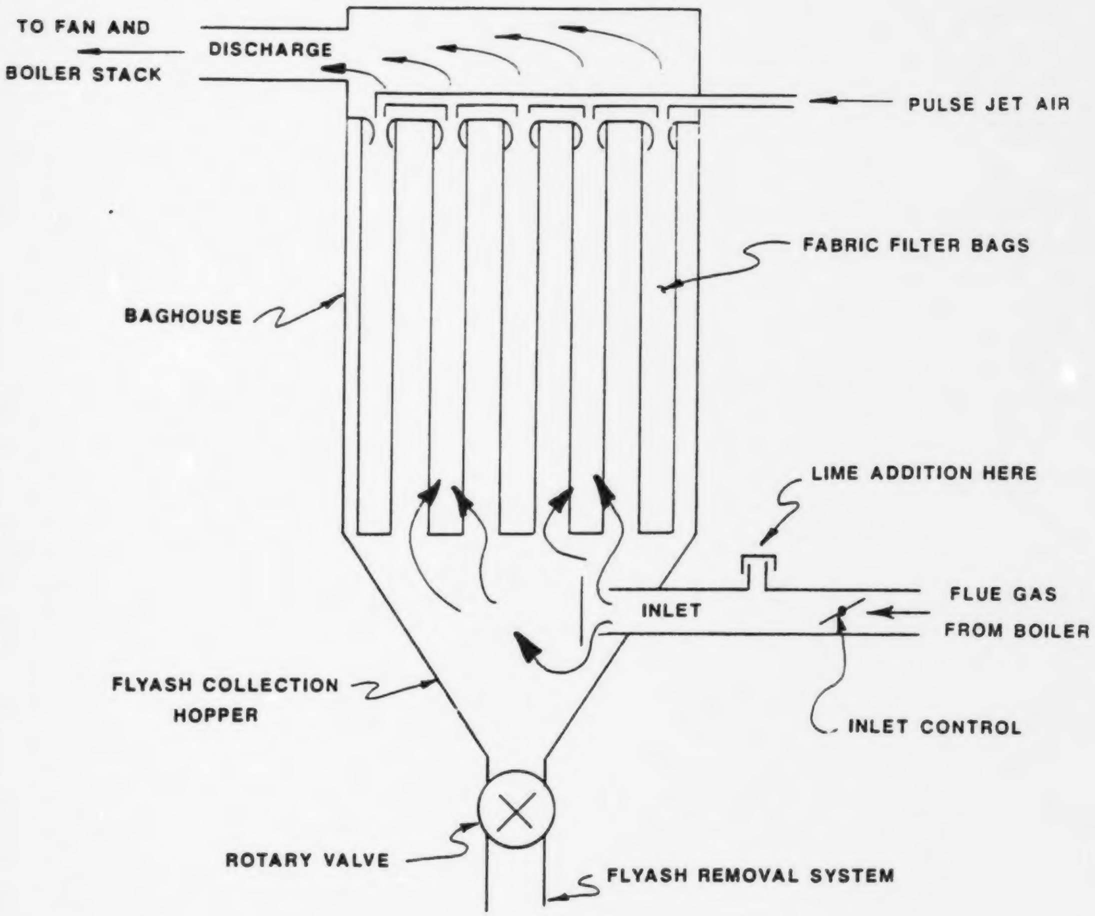

TO FAN AND
BOILER STACK
DISCHARGE
PULSE JET AIR
FABRIC FILTER BAGS
BAGHOUSE
LIME ADDITION HERE
FLUE GAS
FROM BOILER
INLET
INLET CONTROL
FLYASH COLLECTION
HOPPER
ROTARY VALVE
FLYASH REMOVAL SYSTEM

DIAGRAM OF DUST COLLECTOR

FIG. 8.1

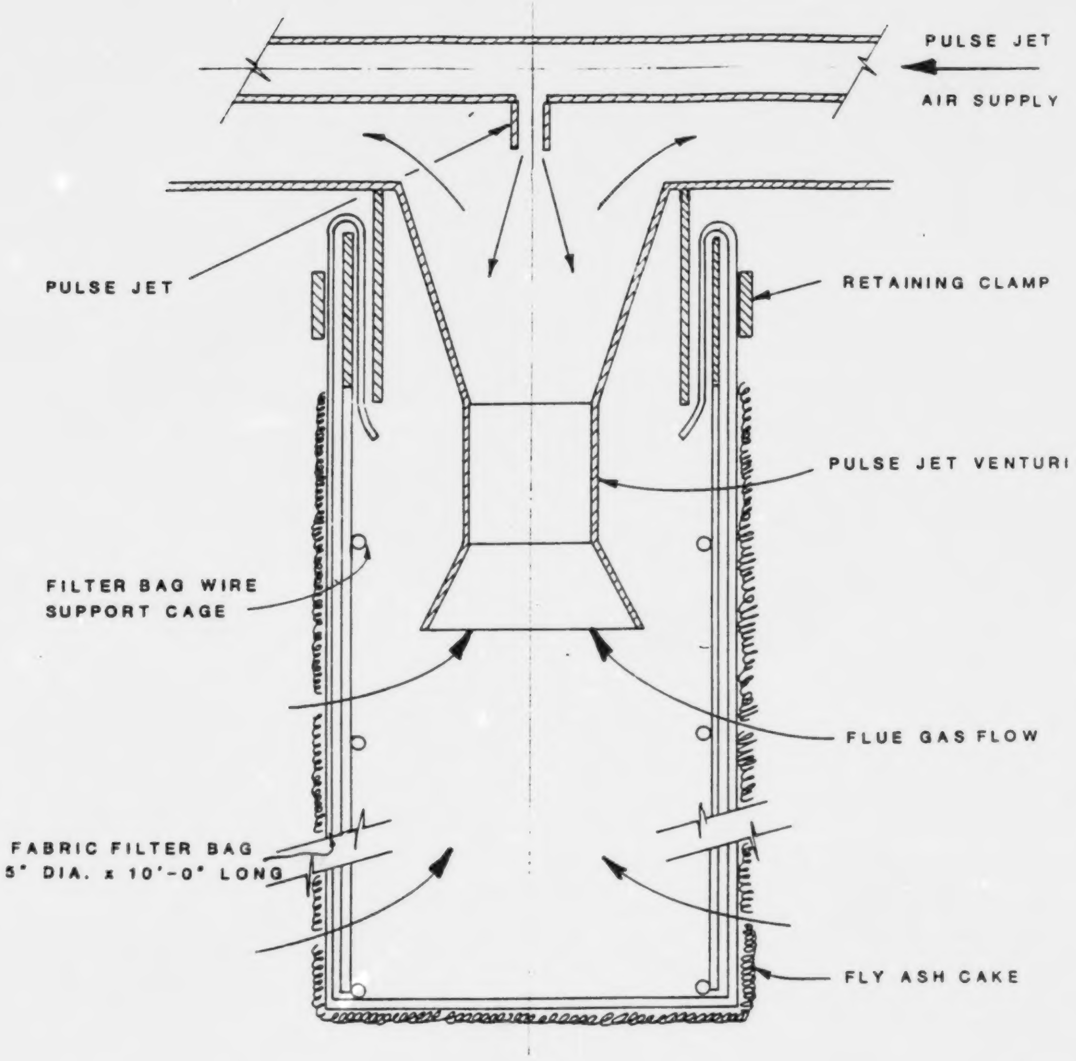

PULSE JET
AIR SUPPLY
PULSE JET
RETAINING CLAMP
PULSE JET VENTURI
FILTER BAG WIRE SUPPORT CAGE
FLUE GAS FLOW
FABRIC FILTER BAG
5" DIA. x 10'-0" LONG
FLY ASH CAKE

DIAGRAM OF FILTER BAG, TOP CONNECTION AND PULSE CLEANING JET

FIG.8.2

9.0 INSTALLATION OF PILOT BAGHOUSE

The baghouse was located on the boiler house roof, adjacent to the breeching from the Unit No. 1 boiler (see fig. 9.1).

The roof was used despite its' exposed location for four reasons:

- ease of access.
- short runs of ducting to and from the existing breeching.
- it was the only space available.
- the roof support steel had been checked, and found to be adequate to carry the additional load.

Short support stubs were welded to the existing roof steel. These stubs were extended up through holes cut in the concrete roof panels. Steel beams were attached to the stubs so that the baghouse base frame was above the finished roof and no load was put on the existing roof panels. Good access was maintained to roof under the new beams, should the roof have to be replaced in the future.

The baghouse was supplied in three sections so that it could be lifted by a crane with an extended boom to the roof and placed on the new support beams. The I.D. fan was installed in a similar manner. Once the baghouse and I.D. fan were located it was a simple matter to install the ducting.

The inlet plenum and baghouse were insulated because the demonstration was conducted during the cold winter months. The discharge ducting and fan were not insulated in order to keep the cost of the demonstration to a minimum.

The fly ash collection system could not be installed on the roof because of the cold weather and strong winds that could be expected during the time of the demonstration. As a point of interest part of the demonstration was conducted during a heavy snow storm, with high winds and an outside temperature of -15°C. Two concrete roof panels (15" wide x 48" long) were removed so that three fly ash lines could be run down to the floor below the roof, where the fly ash was collected in three large drums. (see fig. 9.2) This system was suitable for the short duration of this demonstration but would not be suitable for a continuous operation. Three separate collection drums were used so that performance of each section of the baghouse could be evaluated. The aluminum cladding over the baghouse insulation was continued down over the support legs to form an enclosure to protect the operator when dumping the fly ash from the hoppers below the baghouse down into the collection drums. This enclosure also kept the discharge lines and valves warm, as hot air from the boiler house could rise through the roof where the two panels had been removed. (see fig. 9.3)

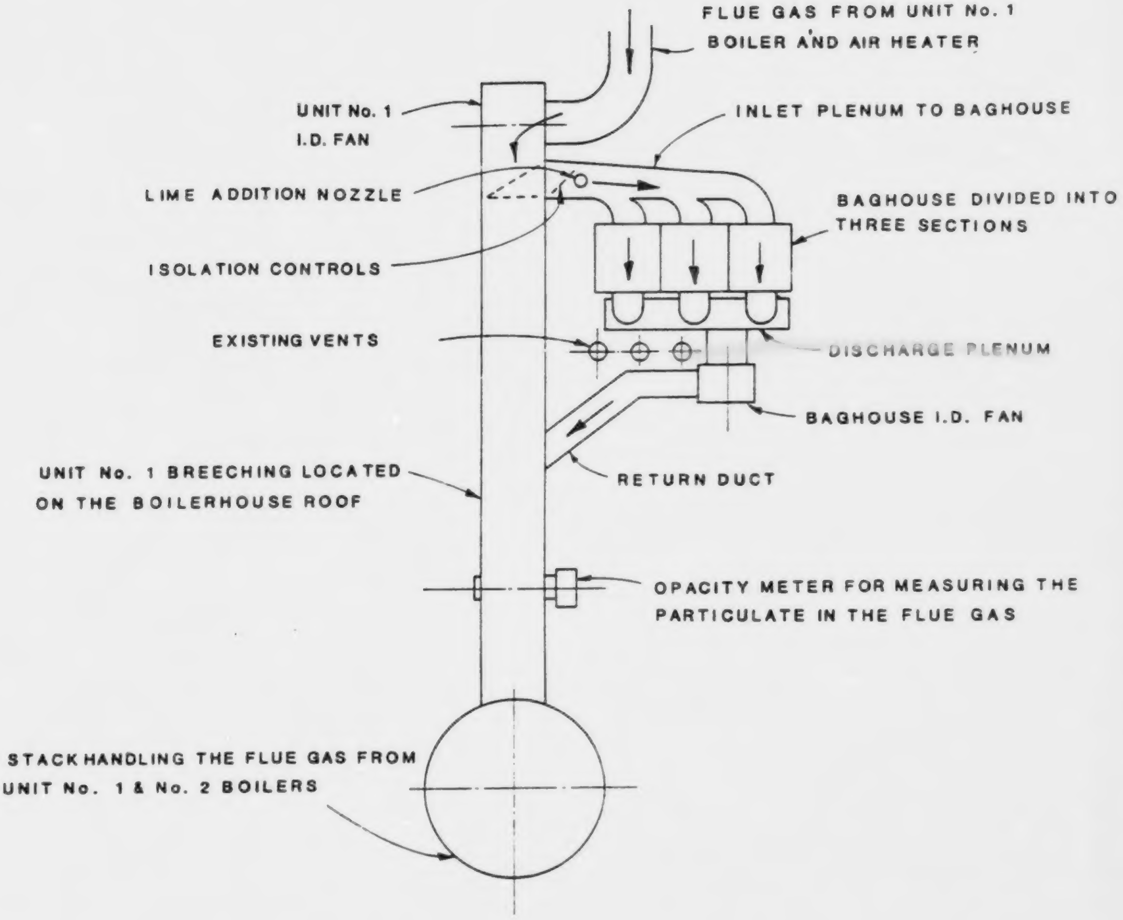
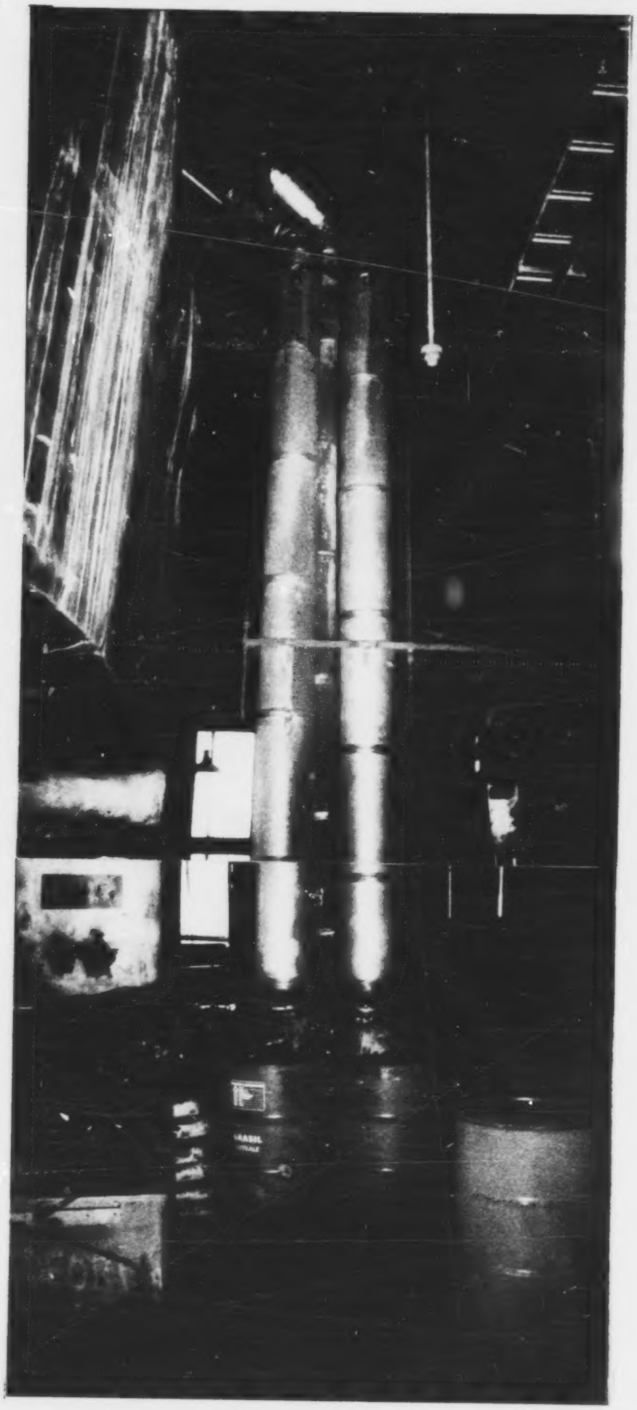

FLUE GAS FROM UNIT No. 1 BOILER AND AIR HEATER
UNIT No. 1 I.D. FAN
INLET PLENUM TO BAGHOUSE
LIME ADDITION NOZZLE
BAGHOUSE DIVIDED INTO THREE SECTIONS
ISOLATION CONTROLS
EXISTING VENTS
DISCHARGE PLENUM
BAGHOUSE I.D. FAN
UNIT No. 1 BREECHING LOCATED ON THE BOILERHOUSE ROOF
RETURN DUCT
OPACITY METER FOR MEASURING THE PARTICULATE IN THE FLUE GAS
STACK HANDLING THE FLUE GAS FROM UNIT No. 1 & No. 2 BOILERS

DIAGRAM SHOWING THE LOCATION OF THE PILOT BAGHOUSE IN THE UNIT No.1 FLUE GAS BREECHING

FIG.9.1

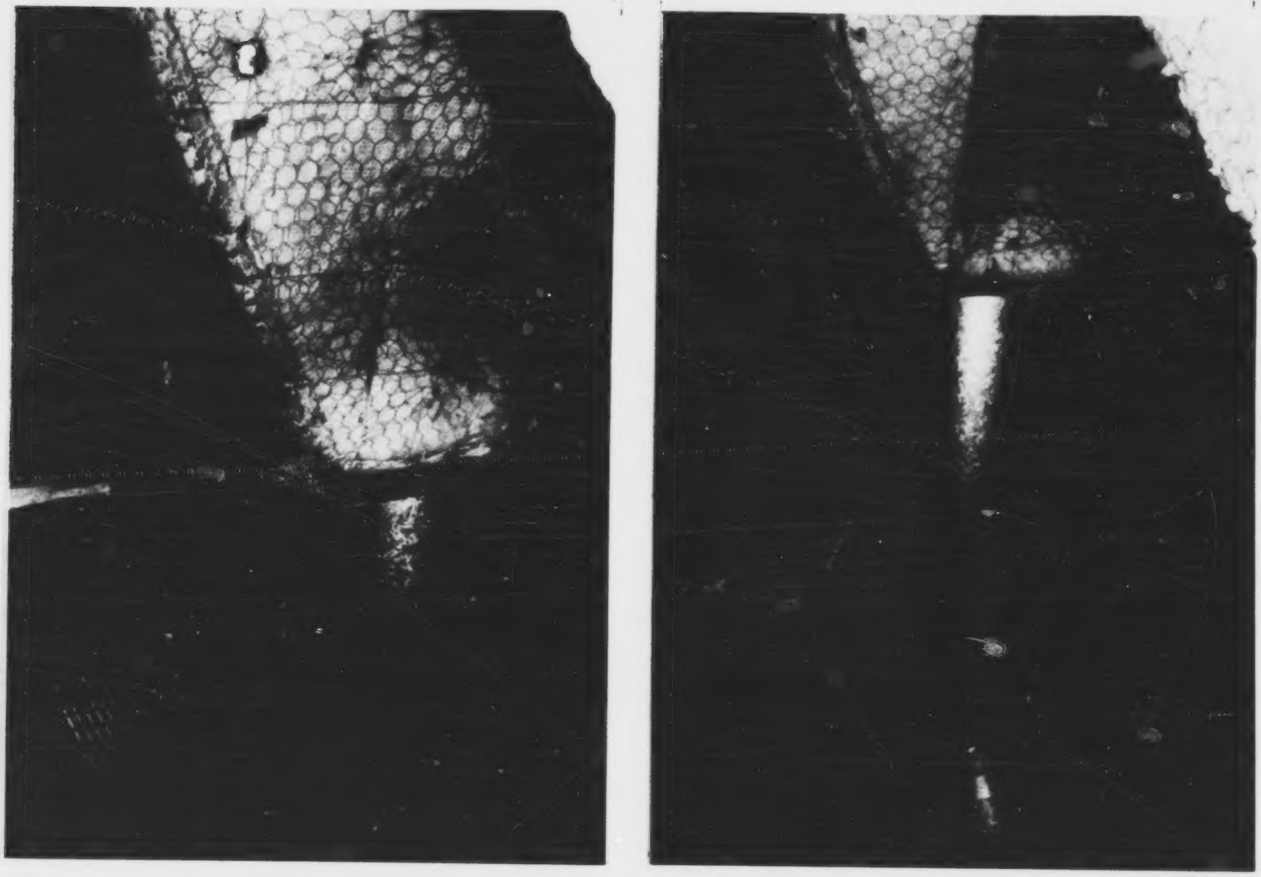
FILM - 5
FRAMES - 7 & 10



VIEW OF FLYASH DISCHARGE LINES

SEPERATE DISCHARGE LINES WERE USED FROM EACH SECTION OF THE BAGHOUSE SO THAT THE FLYASH COLLECTION PERFORMANCE OF EACH TYPE OF BAG COULD BE ASSESSED

FIG. 9.2



FILM - 2
FRAME - 4

DISCHARGE FROM
BAGHOUSES No. 2 (POLYESTER)
AND No. 3 (NOMEX)

FILM - 2
FRAME - 5

DISCHARGE FROM
BAGHOUSE No. 1 (FIBERGLASS)
SHOWING KNIFE GATE VALVE

VIEW OF COLLECTION HOPPERS IN THE ENCLOSURE BELOW THE BAGHOUSE

FIG. 9.3

10.0 TEST PLAN

The first part of planning for the test program was to establish which fabric would be used for each set of filter bags. The filter bag manufacturer supplied the following data on filter bag fabrics:

a) Fabric Selection

Polyester

Polyester fabrics offer good resistance to most acids, oxidizing agents and organic solvents. Concentrated sulphuric and nitric acids are the exception. Polyesters are dissolved by alkalies at high concentrations. Maximum operating temperatures are 149°C (300°F).

Nylon

Nylon fabrics have good tensile strength and alkali resistance. However, nylon is degraded by mineral acids and oxidizing agents. This reaction is accelerated at high concentrations and temperatures. Maximum operating temperatures are 107°C (225°F).

Polypropylene

Polypropylene fabrics offer good tensile strength and abrasion resistance. They perform well in organic and mineral acids, solvents and alkalies. Polypropylene is attacked by nitric and chlorosulphonic acids, sodium and potassium hydroxide at high temperatures and concentrations. Maximum operating temperatures are 95°C (200°F).

Acrylics

The resistance of acrylic fibres is excellent in organic solvents, good in oxidizing agents, mineral and organic acids and fair in alkalies. They are subject to sulphuric acid attack. Maximum operating temperatures are 120°C (250°F).

Nomex

Nomex nylon fabrics resist attack by mild acids, mild alkalies and most hydrocarbons. Resistance to sulfur oxides above the acid dew point at temperatures above 200°F is better than for polyester. Flex resistance of Nomex is excellent. Maximum operating temperatures are 220°C (425°F).

Glass

Glass fabrics offer outstanding performance in high heat applications. They are completely resistant to acids except hydrofluoric and hot phosphoric in their most concentrated forms but are attacked by strong alkalies at room temperature and weak alkalies at higher temperatures. Glass is vulnerable to damage caused by abrasion and flex. Maximum operating temperatures are 290°C (550°F).

Cotton

Cotton fabrics have good abrasion resistance and mechanical strength. They are however subject to rot, mildew and shrinkage. Maximum operating temperatures are 95°C (200°F).

b) Filter Cloth Characteristics

Table 10.1

FIBRE	MAXIMUM OPER. TEMP.		ACID RESIST.	ALKALI RESIST.	DRY HEAT RESIST.	WET HEAT RESIST.	FLEX & ABRASION RESIST.
	°F	°C					
Polyester (Terylene-Dacron)	300	149	Good	Good	Good	Good	Very Good
Nylon (Neotex)	225	107	Fair	Excellent	Good	Good	Excellent
Polyproplex (Propex)	200	95	Excellent	Excellent	Fair	Fair	Very Good
Acrylic (Orlon)	250	120	Excellent	Fair	Good	Good	Fair
Aramid (Normex)	425	220	Fair	Excellent	Excellent	Excellent	Very Good
Glass	550	290	Good	Fair	Excellent	Excellent	Poor
Cotton	200	95	Poor	Fair	Fair	Fair	Good

c) Operating Temperature

Data from previous boiler testing had shown, at full load the flue gas temperature from the discharge of the air heater averaged 300°F (150°C). After this the flue gas passed through the I.D. fan which would ensure good mixing of the flue gas, resulting in a uniform gas temperature. This was confirmed by the flue gas temperatures that were measured during the baghouse demonstration.

As can be seen from the above Table 10.1, an operating temperature 300°F (150°C) would eliminate four of the seven fabrics that were available.

d) Fabric Selected

i) Fiberglass - This is a woven fabric with good high temperature characteristics but poor flexibility. This could be a problem due to the pulse jet cleaning, which causes the fabric to flex back and forth when hit with the compressed air used to knock the fly ash cake from the bag.

Also the glass fabric has only a fair performance rating when subject to alkali which could be a problem when coated with lime.

ii) Nomex - (Aramid) This a felted material which would make it a good fabric to compare to the fiberglass which is woven fabric. This fabric also has a fairly good temperature characteristic, and the added advantages of having good flexibility.

The only problem it is only rated as fair when subject to acid, as would be encountered when burning high sulphur fuels. This could be partly offset by the lime coating of the filter bags.

iii) Polyester - This fabric was used because of the good overall rating given for it in all areas except temperature. The maximum operating temperature was 300°F, which was equal to the temperature of the flue gas in the Unit No. 1 breeching where the flue gas would be taken from.

Another important point in favour of testing this fabric is it had a much lower cost than the other two.

iv) Cost - The following costs per filter bag were quoted by the baghouse manufacturer:

polyester	$ 6.75
nomex	$32.00
fiberglass	$75.50

e) Test Program

As the baghouse demonstration was to be run at the same time as the NRC burner demonstration, a test program had to be developed that would allow the two to be run concurrently. Also the length of the program would be limited by the amount of fuel that was available for the NRC burner demonstration.

For the first test it was planned not to put the baghouse in service until the Unit No. 1 boiler was burning only CWF. This was done to eliminate the risk of blinding the new filter bags with oily fly ash. Once the baghouse operation had been checked out, and the rate of fly ash cake buildup had been established, the flue gas from fuel oil and CWF firing would be tested. Only after these steps had been completed would flue gas from 100% fuel oil firing be passed through the baghouse.

During the time the baghouse was in service the following readings were taken and recorded. See figure 10.1 for the location where the measurements were taken.

i - load on unit, this was recorded as part of NRC burner demonstration.

ii - inlet to baghouse

- flue gas flow *
- flue gas velocity *
- flue gas temperature
- flue gas pressure

iii - discharge from each section of the baghouse

- flue gas flow *
- flue gas velocity *
- flue gas temperature
- flue gas pressure

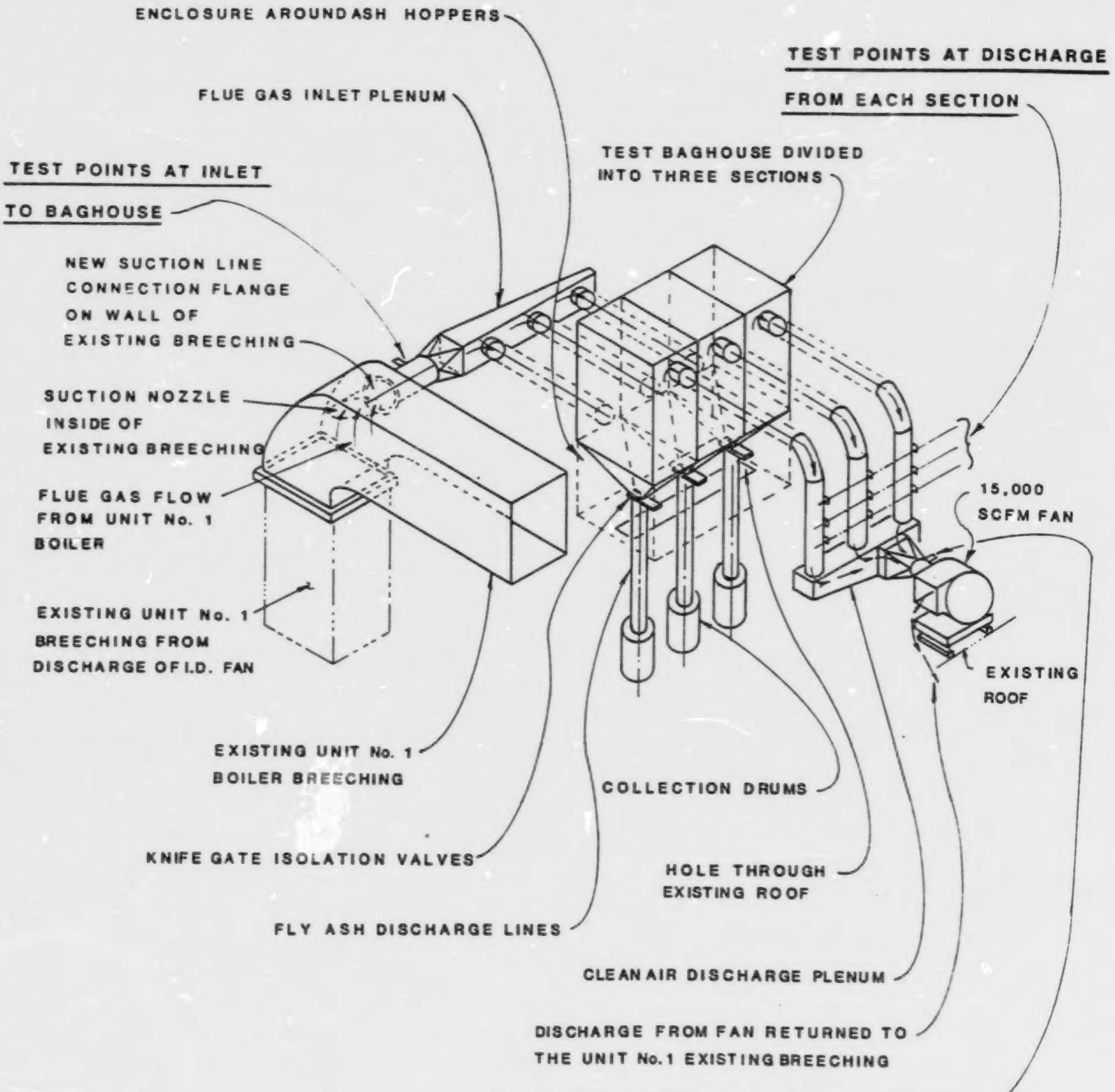
iv - inlet to I.D. fan

- flue gas flow *
- flue gas velocity *
- flue gas temperature
- flue gas pressure

v - main breeching (after the gas from the baghouse has been returned)

- flue gas flow *
- flue gas velocity *
- flue gas pressure

* calculated from the velocity pressure.


ENCLOSURE AROUND ASH HOPPERS
TEST POINTS AT DISCHARGE FROM EACH SECTION
FLUE GAS INLET PLENUM
TEST BAGHOUSE DIVIDED INTO THREE SECTIONS
TEST POINTS AT INLET TO BAGHOUSE
NEW SUCTION LINE CONNECTION FLANGE ON WALL OF EXISTING BREECHING
SUCTION NOZZLE INSIDE OF EXISTING BREECHING
FLUE GAS FLOW FROM UNIT No. 1 BOILER
15,000 SCFM FAN
EXISTING UNIT No. 1 BREECHING FROM DISCHARGE OF I.D. FAN
EXISTING ROOF
EXISTING UNIT No. 1 BOILER BREECHING
COLLECTION DRUMS
KNIFE GATE ISOLATION VALVES
HOLE THROUGH EXISTING ROOF
FLY ASH DISCHARGE LINES
CLEAN AIR DISCHARGE PLENUM
DISCHARGE FROM FAN RETURNED TO THE UNIT No.1 EXISTING BREECHING
TEST POINT FOR TOTAL FLOW AND INLET CONDITIONS TO FAN

LOCATION OF TEST POINTS
ON PILOT BAGHOUSE

FIG.10.1

11.0 Actual Test Program

Installation of the pilot baghouse was completed by mid-February 1986, by which time the second larger NRC gun/atomizer was delivered and the EMR burner modifications had been undertaken.

Therefore once the Chatham Unit No. 1 boiler was in-service burning coal-water fuel (C.W.F.) the baghouse test program could be undertaken.

11.1 Week of February 17 to 21, 1986

During this first week, very little testing could be done because the boiler was only in-service for a short time due to a vacuum problem in the turbine condenser. Therefore the baghouse program was limited to air flow test using the baghouse I.D. fan and the coating of the filter bags with lime.

The following reading was taken during the air flow test:

Table 11.1

With only One Section of the Baghouse In-service at a Time

Section #1 (roadway side) - Fiberglass
Section #2 (middle unit) - Polyester
Section #3 (river side) - Nomex

	COMPT. #1	COMPT. #2	COMPT. #3
Readings	1.7" WG	0.87" WG	1.8" WG
from	1.7" WG	1.1" WG	1.9" WG
Discharge Ducts	1.6" WG	1.1" WG	1.8" WG
on Fan Side of	1.6" WG	1.3" WG	1.7" WG
Discharge	1.7" WG	1.3" WG	1.7" WG
Dampers	1.7" WG	1.3" WG	1.6" WG
Avg. Vel. Head Press.	1.67"WG	1.16" WG	1.75"WG

Static Pressure on Fan Inlet - 6.8" WG
Air Temp - 110°C

Table 11.2

With all Compartments of the Baghouse In-service at one Time

	COMPT. #1	COMPT. #2	COMPT. #3
Readings	0.9" WG	0.65" WG	0.80" WG
from	1.1" WG	0.72" WG	0.80" WG
Discharge Ducts	1.1" WG	0.81" WG	0.79" WG
on Fan Side of	1.0" WG	0.90" WG	0.75" WG
Discharge	1.1" WG	0.93" WG	0.72" WG
Dampers	1.2" WG	0.85" WG	0.72" WG
Avg. Vel. Head Press.	1.07"WG	0.81" WG	0.76" WG
P (Across Bags)	1.5" WG	0.45" WG	1.4" WG

11.2 Week of February 24 to 28, 1986

The main emphasis in the second week was to obtain the optimum settings for the new NRC gun/atomizers and EMR burner modifications that would suit the new fuel (CWF).

On the Monday it was late in the day before the Unit No. 1 boiler was in-service burning only CWF, thus allowing the baghouse to be brought into service. As soon as the baghouse was in-service the opacity reading dropped from 30% to 20%.

Early Tuesday morning, before start-up of the boiler, the baghouse access doors were removed, so that the bags could be inspected. It was found that during the short period of operating the evening before an even cake of coal fly ash, about ¼" (0.6 cm) thick, had built-up on all three sets of filter bags.

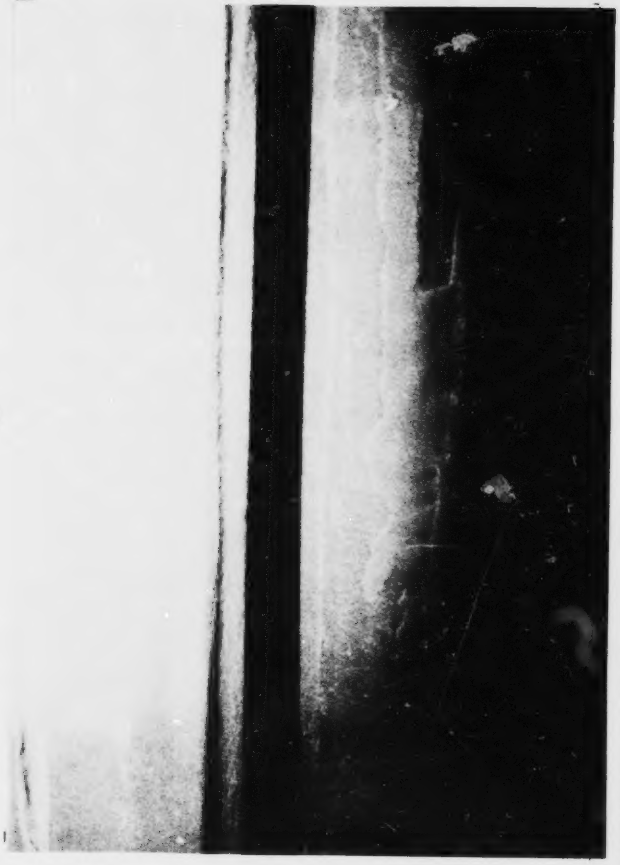
The baghouse was put in service at 10:36 am, and operated all day until 7:30 pm with a mixture of fuel oil and C.W.F. firing.

During the 9 hours the baghouse was in-service the changes in pressure drops (△P) were recorded. By 7:30 pm the pressure drops had built up to:

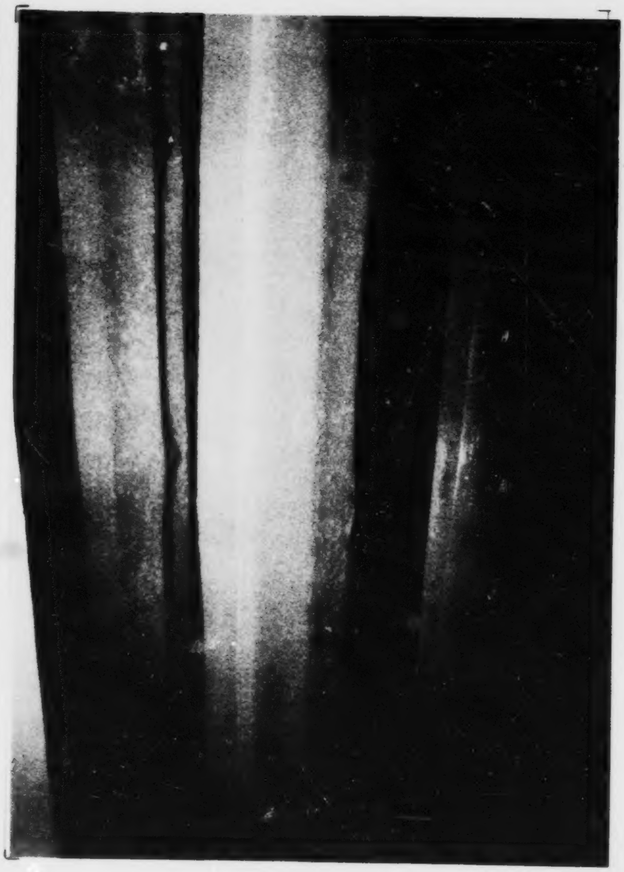
Section and Fabric	△ P before Cleaning	△P after cleaning
No. 1 - fiberglass	6.6" WG	3.0" WG
No. 2 - polyester	5.4" WG	2.5" WG
No. 3 - Nomex	6.3" WG	2.0" WG

The fiberglass and polyester filter bags took 6 to 7 minutes for the △P to drop, whereas the Nomex filter bags cleaned quite quickly and were down to 2.0" WG after two cleaning cycles which only took a couple of minutes.

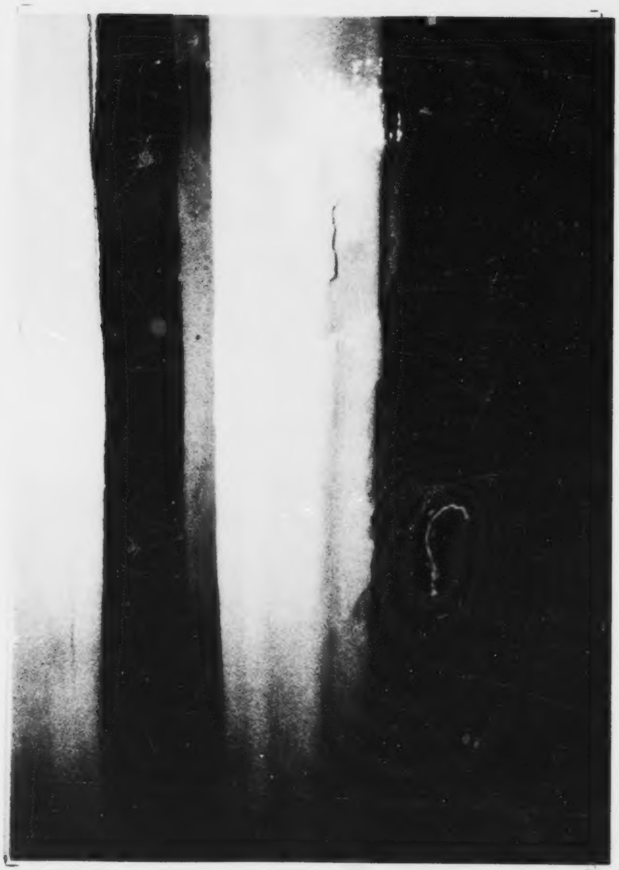
FILTER BAGS AFTER BEING IN SERVICE FOR 10 HRS. AND CLEARED ON-LINE



FILM - 1
FRAME - 0



FILM - 1
FRAME - 2



FILM - 1
FRAME - 5

1 (FRAME 0) FIBERGLASS *
2 (FRAME 2) POLYSTER
3 (FRAME 5) NOMEX *
* WITH SOME OF THE FLYASH CAKE STILL ON BAG

FIG. 11.1

This completed the testing for the second week as all the first shipment of CWF had been burnt. The size of fuel shipments for this demonstration was limited in size for two reasons:

1. the problems which had been experienced with the fuel in the past and,

2. Unit No. 2 was not available to assist with burning should there be any problems with Unit No. 1

The filter bags could not be inspected right away because of a snow storm which would have made them wet.

The filter bags were inspected a few days later and as can be seen from fig. 11.1, some of the fly ash cake was still on the fiberglass and nomex filter bags whereas the polyester filter bags only have a light even coat of fly ash on them.

The fiberglass filter bags which were a black color had retained most of their lime (white) pre-coating. It was difficult to judge if the polyester and nomex filter bags still had lime on them because both the filter bags and lime were white.

11.3 Week of March 5 to 8, 1986

During this week the baghouse was in continuous operation for 26 hours, while the CWF guns and heavy fuel guns were in-service. The change in pressure drop across each section of the baghouse was recorded approximately every half hour and these readings are listed in Table 12.1. When the pressure drop built up 6 inches water gauge the on-line pulse jet bag cleaning system was put in to service long enough to reduce the pressure drop down to 2 inch water gauge. The rate of buildup and cleaning cycles are shown on the graphs plotted on figs. 12.1, 12.2 and 12.3, in section 12 - Test Results.

After 19 hours operation at 6:30 am, the pressure drop in the middle section, which contained the polyester filter bags, dropped to ½ inch water gauge and only picked up slightly during the next few hours of operation.

Later in the morning this middle section of the baghouse was isolated, and upon inspection of the fly ash collection drums, pieces of the polyester filter bags were found in the drum below the middle section. At no time was the temperature of the flue gas entering the baghouse found to be more than 300°F (150°C), the maximum temperature the polyester filter bags were rated for. The texture of polyester filter bags had changed from a thick, tough, felted fabric to one similar to soft blotting paper with no strength. Later when one of the filter bags was removed from the baghouse it was found to be so weak there were long tears along the wires which formed the support cage for the filter bag. This is a point where there would be maximum stress due to the flexing of the filter bag during the pulse jet cleaning.

FILTER BAG AFTER BEING IN-SERVICE FOR 36 HRS.

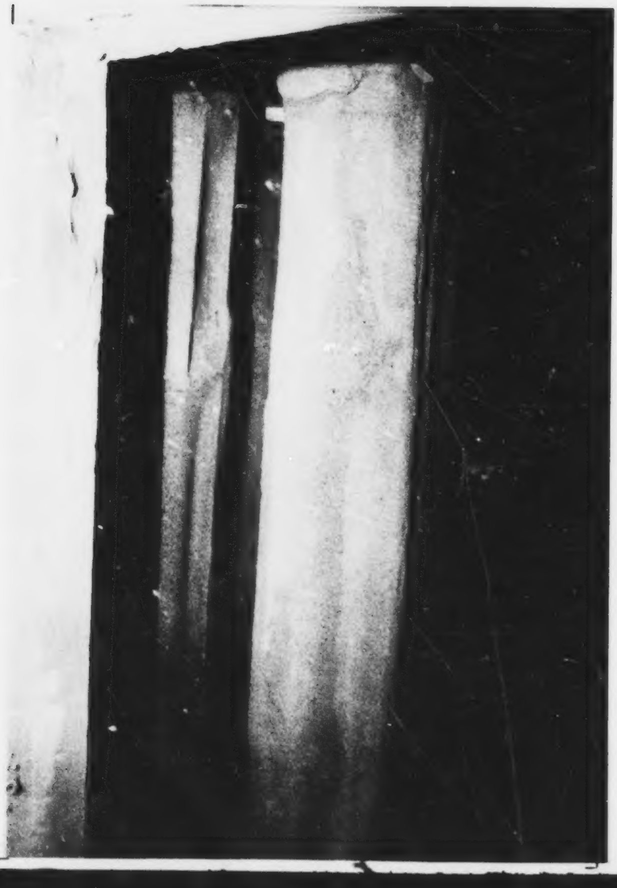
FILM - 5
FRAME - 3

FIBERGLASS BAGS AFTER OFFLINE CLEANING

SOME OF THE FLYASH CAKE IS STILL ON THE BAGS

NOTE :
BY THIS TIME.
THE POLYESTER BAGS
HAD FAILED

FILM - 5
FRAME -2



NOMEX BAGS AFTER OFF-LINE CLEANING.

ONLY A LIGHT COAT OF FLYASH IS LEFT ON THE BAGS.

FIG. 11.2

Any part of the polyester filter bags that had been in service could be torn easily by hand. The filter bag supplier said this was typical of filter bag failure when the bags had been subjected to too high a temperature.

After completion of the test program the two remaining sections were inspected. They had been cleaned on-line shortly before the unit was shut down. The unit had to be shut down because all the available fuel had been burnt.

The Nomex filter bags were found to have quite a buildup of fly ash on them but it came off quite easily when the filter bags were knocked by hand.

The Fiberglass filter bags had less of a buildup but it would not come off when knocked by hand.

The pulse jets were put in service with baghouse doors open, and it could be seen the fly ash came off the Nomex filter bags quickly but not off the Fiberglass filter bags. It should be noted the pulse jet cleaning in the section containing the Nomex filter bags was set at 100 psig whereas the Fiberglass filter bag pulse jet cleaning was set at 50 psig. The 50 psig was the recommended pressure given by the manufacturer because of the low flex strength of the Fiberglass fabric.

The baghouse was closed up and the pulse jets left in service for twenty minutes of off-line cleaning (the I.D. fan was not running). The baghouse I.D. fan was started and the pressure drops were down to:

No. 1 (fiberglass)	2.3" WG
No. 2 (polyester)	out of service
No. 3 (nomex)	1.6" WG

Upon inspection (after the I.D. fans had been shut down) the Fiberglass filter bags looked clean but, there was a thin film of fly ash on the Nomex filter bags. This fly ash came off ready and could have been reintrainment caused by the "stack effect", (ie. there was quite an air flow through the baghouse because the boiler stack was still warm which caused air to continue to flow up the stack). For details of these filter bags see fig. 11.2.

Later a pair of Nomex and Fiberglass filter bags, that had been in service, were taken to R.P.C. in Fredericton to determine if there was any "blinding" of either of the filter bags. A pair of filter bags was also sent to NRC for similar examination plus a sample of the Polyester filter bag.

NRC confirmed the Polyester filter bags were made from a polyester fabric. This examination was undertaken to ensure the correct fabric had been used because the filter bags had failed at their maximum rated operating temperature. Also as most of the fabric looks alike (white felt) the wrong fabric could have been used in error.

Neither R.P.C. nor NRC could detect any "blinding" of the Nomex or Fiberglass fabric. Copies of these reports are included in the Appendix to this report.

12.0 Test Results

The reading of the pressure drops across the three sections of the baghouse are recorded in Table 12.1 and graphs showing the rate of filter cake buildup (change in ΔP) are illustrated on the graphs detailed on:

Fig. 12.1 fiberglass bags - (Section #1)
Fig. 12.2 polyester bags - (Section #2)
Fig. 12.3 nomex bags - (Section #3)

From these curves it can be seen for the Fiberglass filter bags the ΔP did not drop back to the original level after on-line cleaning. Over the whole program there was a continuous increase in ΔP after on-line cleaning for these fiberglass filter bags. At first it was felt these filter bags were starting to "blind" but after prolonged off-line cleaning the ΔP came down to close to its original level.

In the early part of the program, based on the slow rate of ΔP increase, and quick cleaning (drop in ΔP) the Polyester filter bags appeared to be performing the better of the three sets of filter bags. But when comparing the amount of fly ash in the collection drums, after the filter bags had been cleaned, (see Table 12.2) very little fly ash was collected by the Polyester filter bags. This can not be explained unless one or two of the bags had failed much earlier than expected, or the Polyester fabric was allowing the very fine fly ash particles to pass through.

The amount of fly ash collected in the drums below each section of the baghouse is recorded in Table 12.2.

The "Nomex" filter bags collected an equal amount of fly ash to the "Fiberglass" filter bags, and cleaned much better with the on-line pulse jet cleaning.

From the laboratory examinations conducted on the Fiberglass and Nomex filter bags, that had been in service, there were no signs of "blinding" of either fabric. These reports are included in the Appendix to this report.

The lime and number of cleaning cycles required to clean each set of filter bags is recorded in Table 12.3.

The flue gas flows were calculated through each section of the baghouse, and were almost equal for sections #1 and #3, but the flow through section #2 was the highest of the three.

BAGHOUSE DEMONSTRATION
AT
N.B. POWER'S CHATHAM T.G. STATION

TABLE 12.1

PRESSURE DROP ACROSS EACH SECTION
OF THE BAGHOUSE
ALL READINGS IN: INCHES WATER GAUGE

		BAGHOUSE SECTION		
DATE	TIME OF READING	NO. 1 FIBERGLASS	NO. 2 POLYESTER	NO. 3 NOMEX
20 Feb. 86	11:20 AM	0.2	0.65	0.2
	11:30 AM	1.5	1.45	1.4
24 Feb. 86	7:00 PM	2.0	1.3	1.9
	7:30 PM	2.8	1.9	2.5
	8:00 PM	3.0	2.0	2.6
		BAGHOUSE PUT BACK IN-SERVICE		
25 Feb. 86	10:36 AM	3.0	2.0	2.6
	11:00 AM	3.5	2.3	3.1
	12:02 PM	4.0	2.8	3.6
	1:00 PM	4.4	3.2	4.0
	2:00 PM	4.9	3.6	4.4
	2:27 PM	5.1	3.9	4.7
	3:35 PM	5.3	4.0	4.9
	4:40 PM	5.6	4.4	5.2
	5:20 PM	5.9	4.7	5.5
	7:00 PM	6.4	5.2	6.1
	7:40 PM	6.6	5.4	6.3
		ON-LINE CLEANING		
	8:00 PM	3.0	2.5	2.0
	UNIT OUT OF SERVICE FOR 8 DAYS			
5 Mar. 86	BAGS PRE-COATED WITH LIME			
	11:35 AM	2.4	1.1	1.3
	12:25 PM	4.0	2.6	3.4
	1:45 PM	4.9	3.4	4.3
		ON-LINE CLEANING		
	2:00 PM	3.7	1.2	2.0
	3.40 PM	4.9	2.4	4.25
	4:00 PM	5.1	2.8	4:40
	4:22 PM	5.1	2.9	4.5
		ON-LINE CLEANING		
	4:30 PM	3.0	1.0	1.9
	4:47 PM	3.8	1.4	2.7
	7:02 PM	5.4	2.8	4.7

TABLE 12.1 (Cont'd)

PRESSURE DROP ACROSS EACH SECTION
OF THE BAGHOUSE
ALL READINGS IN: INCHES WATER GAUGE

DATE	TIME OF READING	BAGHOUSE SECTION NO. 1 FIBERGLASS	NO. 2 POLYESTER	NO. 3 NOMEX
		ON-LINE CLEANING		
	7:15 PM	3.0	1.0	2.0
	9:00 PM	5.4	2.5	4.5
		ON-LINE CLEANING		
	8:15 PM	3.0	not cleaned	3.3
	11:15 PM	4.8	2.6	3.8
6 Mar 86	12:50 PM	5.0	2.4	4.6
		ON-LINE CLEANING PRESSURE NOT RECORDED		
	1:50 AM	4.5	1.8	2.1
	3:00 AM	5.2	2.0	4.2
		ON-LINE CLEANING PRESSURE NOT RECORDED		
	4:00 AM	4.8	1.7	4.0
		ON-LINE CLEANING		
	4:10 AM	3.9	1.0	3.0
	5:35 AM	5.0	1.2	4.2
	6:35 AM	5.2	1.4	4.5
		ON-LINE CLEANING		
	6:45 AM	3.5	0.5	2.1
	9:00 AM	5.4	THIS SECTION TAKEN OUT OF SERVICE	4.8
	11:22 AM	6.2	-	5.6
		SHORT ON-LINE CLEANING		
	11:30 AM	5.0	-	3.5
		LONG ON-LINE CLEANING		
	11:40 AM	4.6	-	3.2
	12:20 PM	5.4	-	4.9
	12:40 PM	6.2	-	5.7
		ON-LINE CLEANING		
	12:50 PM	4.5	-	3.1
	1:10 AM	BOILER SHUT DOWN		
	2:20 PM	BAGS INSPECTED PULSE JET CLEANING PUT IN-SERVICE		
	2:45 PM	CLEANING STOPPED, AND THE BAGHOUSE I.D. FAN RUN TO CHECK PRESSURE DROPS		
		2.3	-	1.6
	3:00 PM	BAGS INSPECTED		

BAGHOUSE DEMONSTRATION
AT
N.B. POWER'S CHATHAM T.G. STATION
FLY ASH COLLECTION

TABLE 12.2

		FLY ASH COLLECTED		
DATE	TIME	DRUM #1	DRUM #2	DRUM #3
25 Feb. 86	7:40 PM	Full	1/2 Full	Full
6 Mar. 86	1:45 PM	2/3	1/6	1/3
	4:22 PM	1/3	1/8	Very Little*
	7:02 PM	Little* Change	1/4	Too much dust in drum to be able to see
	9:00 PM	2/3	1/3 bag not cleaned	over 2/3 plus plus a large amount on the floor
7 Mar. 86	12:50 AM 3:00 AM 4:00 AM	(NOT CHECKED OVER NIGHT BUT DRUMS EMPTIED)		
	6:35 AM		POLYESTER BAGS TAKEN OUT OF SERVICE	
	11:30 AM	Very* Little	POLYESTER BAGS TAKEN OUT OF SERVICE	Over 2/3
	12:40 AM		POLYESTER BAGS TAKEN OUT OF SERVICE	

* When there was very little Fly Ash in drums, it was assumed the ash had hung up in the Baghouse Hopper.

BAGHOUSE DEMONSTRATION
AT
N.B. POWER'S CHATHAM T.G. STATION
CLEANING OF BAGS

TABLE 12.3

DATE	TIME	TIME AND NUMBER OF CYCLES TO CLEAN SECTION		
		SECTION #1 FIBERGLASS	SECTION #2 POLYESTER	SECTION #3 NOMEX
25 Feb. 86	7:40 PM	This Section took sometime to clean.	This Section also took sometime to clean.	TheΔP dropped very quickly in this Section.
6 Mar. 86	1:45 PM	3 full cycles	1 full cycle	2 full cycles
	4:22 PM	3 full cycles	1 full cycle	5 full cycles
	7:02 PM	4 full cycles	1 full cycle	2 full cycles
	9:00 PM	3 minutes	1 minute	2 minutes
7 Mar. 86	12:50 AM 3:00 AM 4:00 AM		(Not Recorded by the Night-Shift)	
	6:35 AM		This Section taken out of Service.	
	* 11:30 AM	Short Clean one cycle		2 cycles
		Long Clean 4 minutes	This Section taken out of Service.	3 minutes
	12:40 PM	3 minutes	This Section taken out of Service.	2 minutes
	2:20 PM		20 minutes of off-line cleaning after shut down in sections 1 and 3.	

Notes: Each Section had 7 rows of 10 filter bags and one cycle was the cleaning of all 7 rows.

* After 2 cycles the Nomex filter bags were down to 3.5" but after 4 minutes the Fiberglass was only down to 4.6".

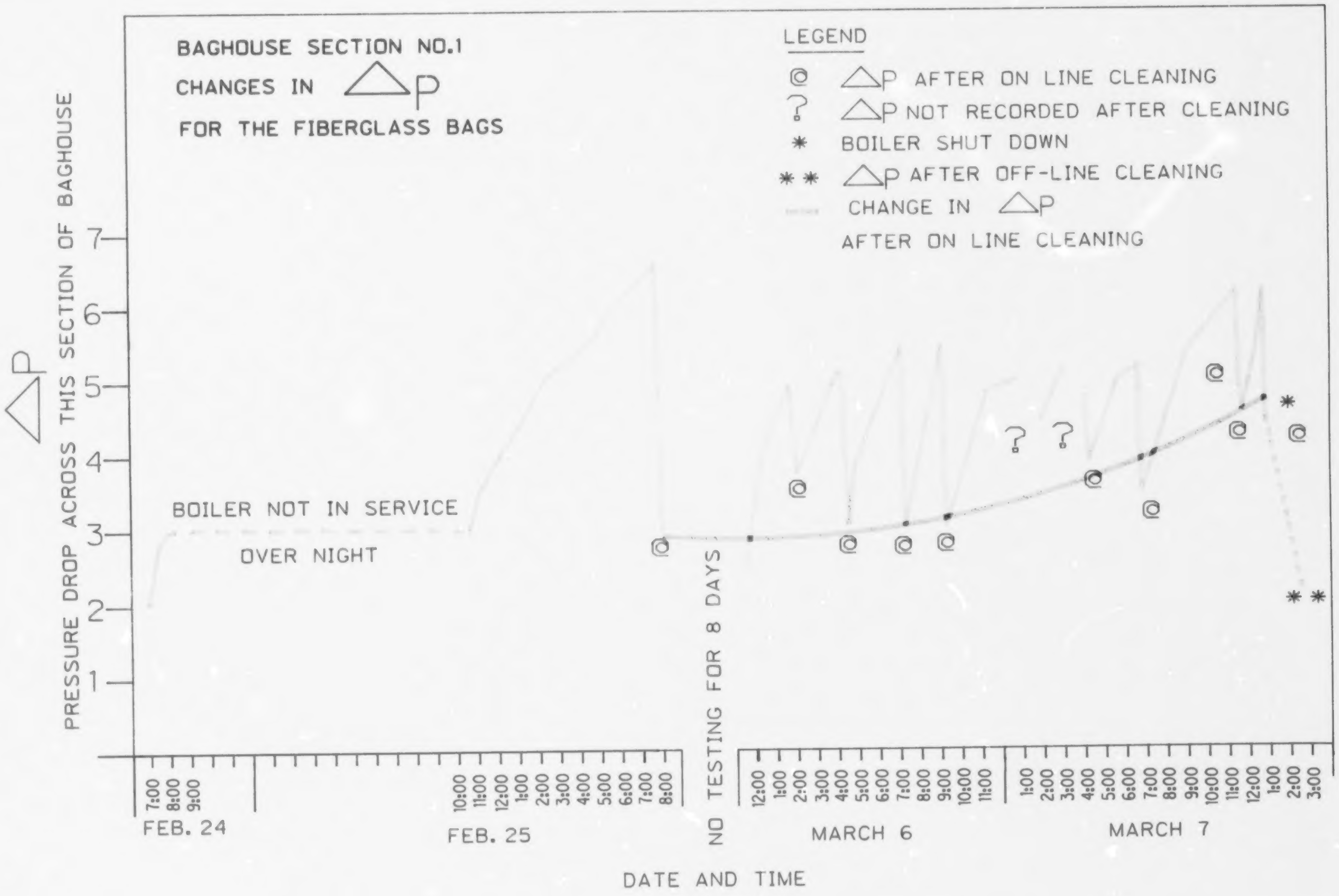

BAGHOUSE SECTION NO.1
CHANGES IN △P
FOR THE FIBERGLASS BAGS
LEGEND
@ △P AFTER ON LINE CLEANING
? △P NOT RECORDED AFTER CLEANING
* BOILER SHUT DOWN
** △P AFTER OFF-LINE CLEANING
CHANGE IN △P AFTER ON LINE CLEANING
BOILER NOT IN SERVICE OVER NIGHT
NO TESTING FOR 8 DAYS
△P
PRESSURE DROP ACROSS THIS SECTION OF BAGHOUSE
1
2
3
4
5
6
7
7:00
8:00
9:00
FEB. 24
10:00
11:00
12:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
FEB. 25
12:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
MARCH 6
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
1:00
2:00
3:00
MARCH 7
DATE AND TIME

FIG 12.1

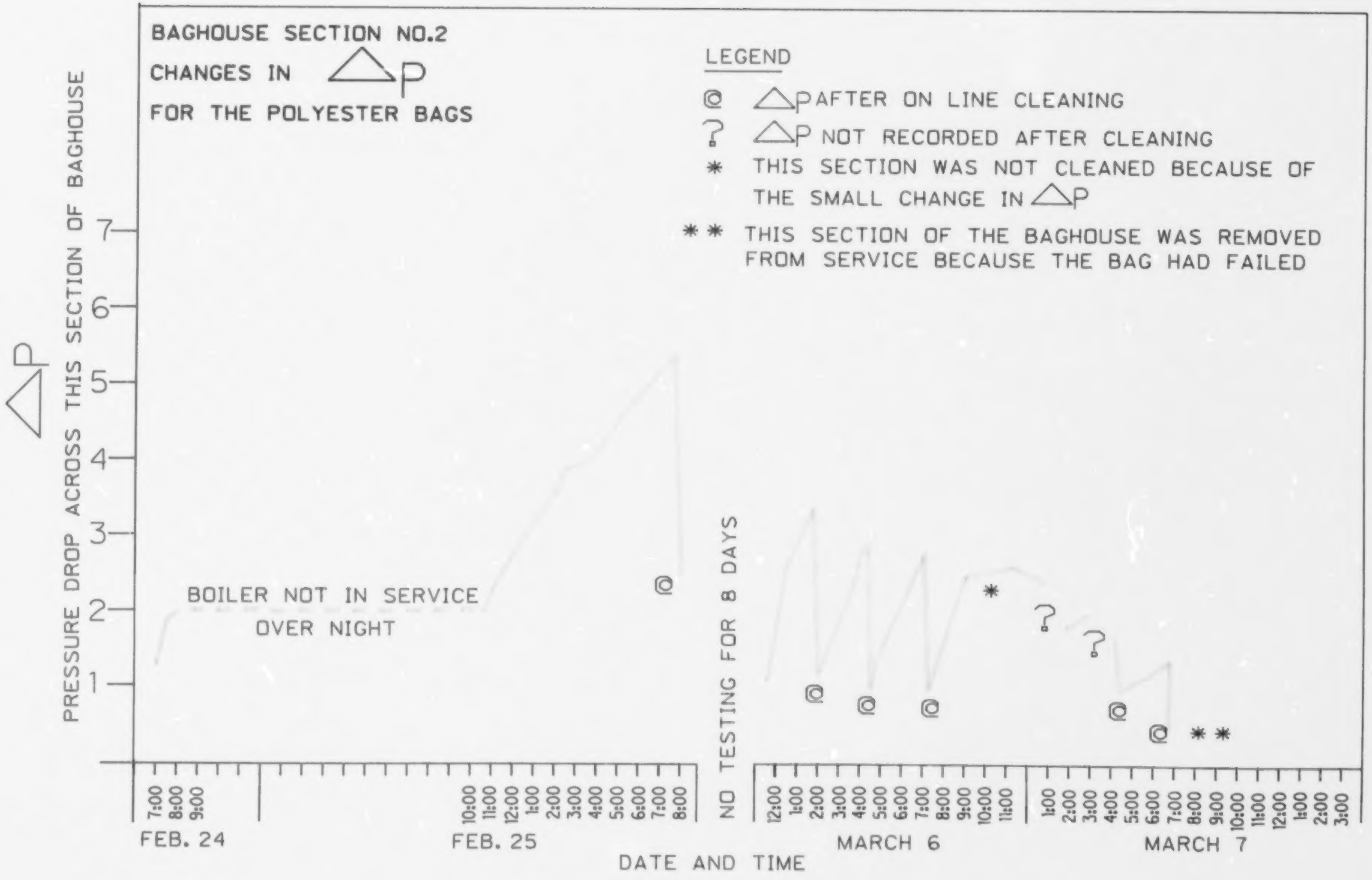

BAGHOUSE SECTION NO.2
CHANGES IN ΔP
FOR THE POLYESTER BAGS
LEGEND
@ ΔP AFTER ON LINE CLEANING
? ΔP NOT RECORDED AFTER CLEANING
* THIS SECTION WAS NOT CLEANED BECAUSE OF THE SMALL CHANGE IN ΔP
** THIS SECTION OF THE BAGHOUSE WAS REMOVED FROM SERVICE BECAUSE THE BAG HAD FAILED
ΔP
PRESSURE DROP ACROSS THIS SECTION OF BAGHOUSE
1
2
3
4
5
6
7
BOILER NOT IN SERVICE OVER NIGHT
NO TESTING FOR 8 DAYS
7:00
8:00
9:00
10:00
11:00
12:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
12:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
1:00
2:00
3:00
FEB. 24
FEB. 25
MARCH 6
MARCH 7
DATE AND TIME

FIG 12.2

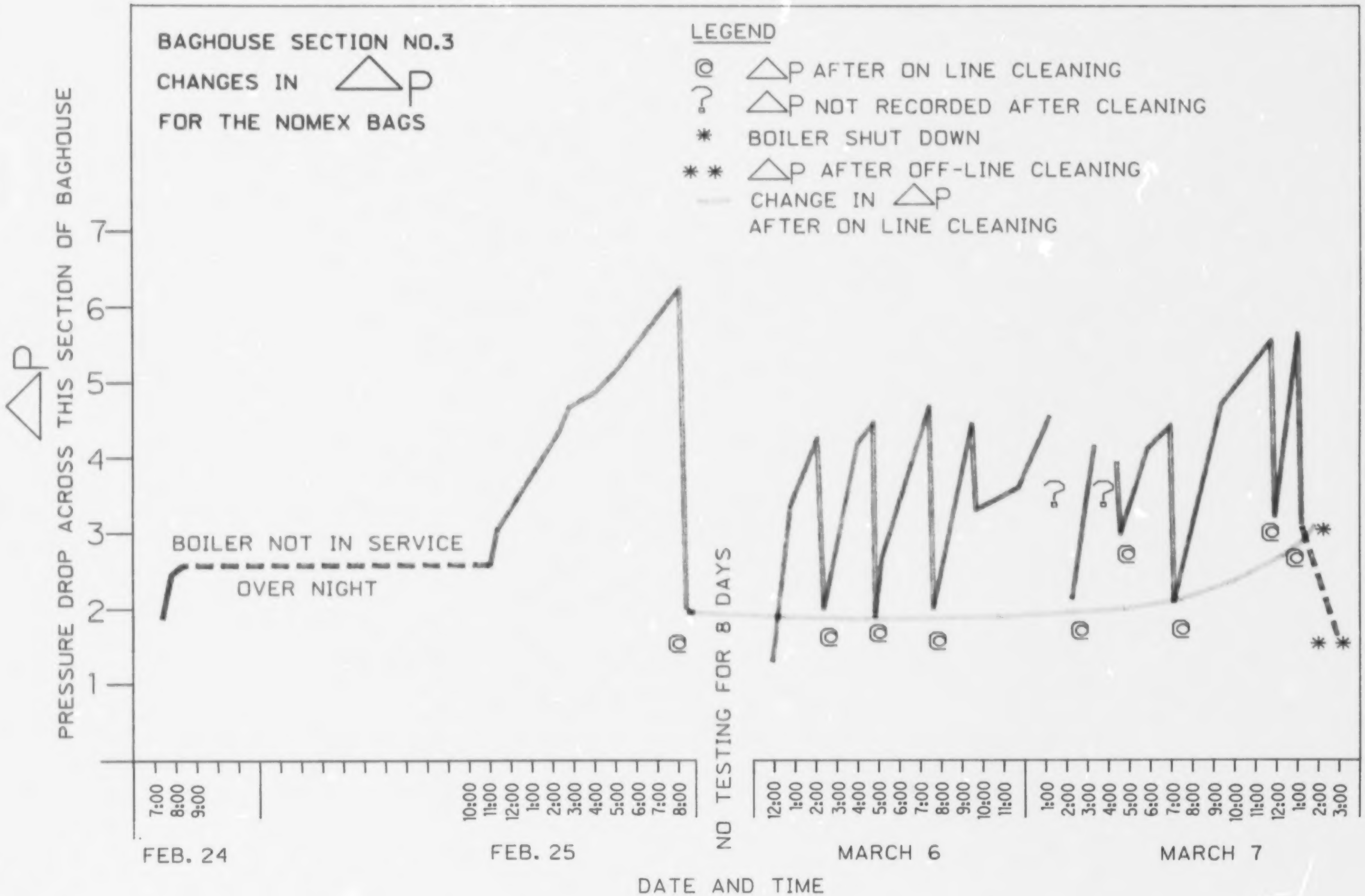

BAGHOUSE SECTION NO.3
CHANGES IN △P
FOR THE NOMEX BAGS
LEGEND
@ △P AFTER ON LINE CLEANING
? △P NOT RECORDED AFTER CLEANING
* BOILER SHUT DOWN
** △P AFTER OFF-LINE CLEANING
CHANGE IN △P AFTER ON LINE CLEANING
△P PRESSURE DROP ACROSS THIS SECTION OF BAGHOUSE
1
2
3
4
5
6
7
BOILER NOT IN SERVICE
OVER NIGHT
NO TESTING FOR 8 DAYS
7:00
8:00
9:00
10:00
11:00
12:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
12:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
1:00
2:00
3:00
FEB. 24
FEB. 25
MARCH 6
MARCH 7
DATE AND TIME

FIG 12.3

13.0 BAGHOUSE OPERATING PROCEDURE

13.1 OUTLINE FOR BAGHOUSE OPERATION

CONDITIONS:- 100% Heavy Fuel Oil.
- A Mixture of Heavy Fuel Oil and CWF.
- 100% CWF (coal-water fuel).
- Switching between Fuels.

1. Pre-coating bags, before start-up to burn fuel oil.

   Note: No pre-coating would be necessary if only C.W.F. was going to be burnt, but this is unlikely at this stage of development of coal water fuels.

2. 100%, fuel oil burning.
3. Before switching to C.W.F. firing, while burning fuel oil.
4. Burning with a mixture of fuel oil and C.W.F.
5. Before switching to 100% C.W.F.
6. 100% C.W.F. firing.
7. Before bringing fuel oil guns back into service.
8. Burning with a mixture of fuel oil and C.W.F.
9. Rate of build-up of fly ash on filter bags.
10. When to clean the filter bags (ie. removal of fly ash.)
11. Time required to remove fly ash from filter bags.
12. Re-coating filter bags with lime.
13. Automatic operation for filter bag cleaning.
14. Continuous operation - alarm for high pressure drop.
15. Removal of fly ash from hopper below filter bags.
16. Preparation for shutdown.
17. Shutdown - Short Term.
18. Shutdown - Long Term.
19. Bag failure - blinding of a filter bag.
20. Bag failure - rupture of a filter bag.

13.2 DETAILS OF BAGHOUSE OPERATIONS, (COVERED IN OUTLINE)

13.2.1. Pre-Coating of Filter Bags

Before the boiler is brought into operation, burning either light or heavy fuel oil the filter bags are to be coated with lime.

This is done by running the baghouse I.D. fan to draw clean air through the filter bags. Once an air flow has been established, dry lime is fed into the inlet plenum of the unit, (see figs. 13.1 & 13.2) through an inlet nozzle, so that the lime is carried by the air flow into the baghouse and deposited on the filter bags. This is done to prevent the very fine and sticky oil fly ash particles becoming trapped within the fabric of the filter bags, which would cause blinding of the filter bag. This blinding would cause a reduction in the flue gas flow and in an extreme case may stop the gas flow.

The addition of the lime is continued until the pressure drop across the baghouse has increased by 0.2 inches water gauge ("WG).

On the Chatham Project it was found 100 pounds of common agriculture lime was sufficient for the approximately 3,000 square feet of filter fabric within the baghouse. This was equal to 0.05 lb/sq. ft. The manufacturer had recommended 0.1 lb/sq. ft.

13.2.2. 100% Fuel Oil Burning

Generally the Dust Collector Industry do not recommend the use of baghouses for the removal of particulate from flue gas when burning fuel oils. Therefore if the unit is to be run for a prolonged period of time burning only fuel oil, it is recommended the flue gas be bypassed around the baghouse.

If the baghouse must be used while fuel oil is being burnt, for example if the flue gas opacity is too high, then the filter bag must be cleaned and coated with lime before the oil guns are brought into service.

As the build-up of fly ash will be very slow while burning fuel oil the filter bags should be recoated with lime every couple of hours to ensure a lime coating is maintained on the filter bag.

13.2.3. Before Switching from Oil Firing to CWF

a) If the baghouse is already in service burning fuel oil, and the filter bags have been coated with lime, there would be no problem to bring CWF guns into service while fuel oil guns were already in service.

b) The unit is in service with only fuel oil guns, and the baghouse is being bypassed:

    i) if the bags have been pre-coated with lime there would be no problem. The baghouse would be brought into service before the CWF guns were lit off.

    ii) but if the bags had not been pre-coated this must be done before the baghouse is brought into service.

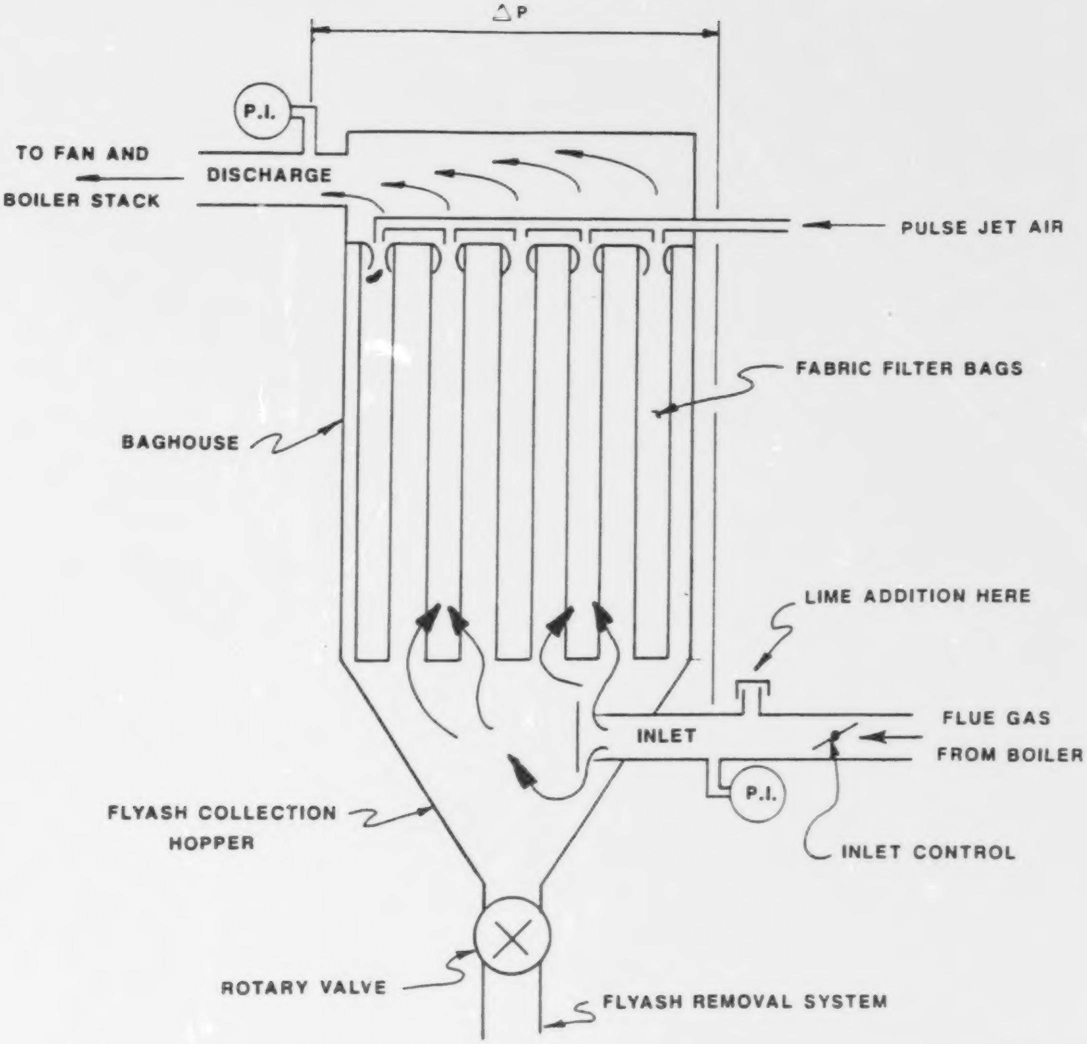

△P
P.I.
TO FAN AND
BOILER STACK
DISCHARGE
PULSE JET AIR
FABRIC FILTER BAGS
BAGHOUSE
LIME ADDITION HERE
FLUE GAS
FROM BOILER
INLET
P.I.
INLET CONTROL
FLYASH COLLECTION
HOPPER
ROTARY VALVE
FLYASH REMOVAL SYSTEM

DIAGRAM OF DUST COLLECTOR

FIG.13.1

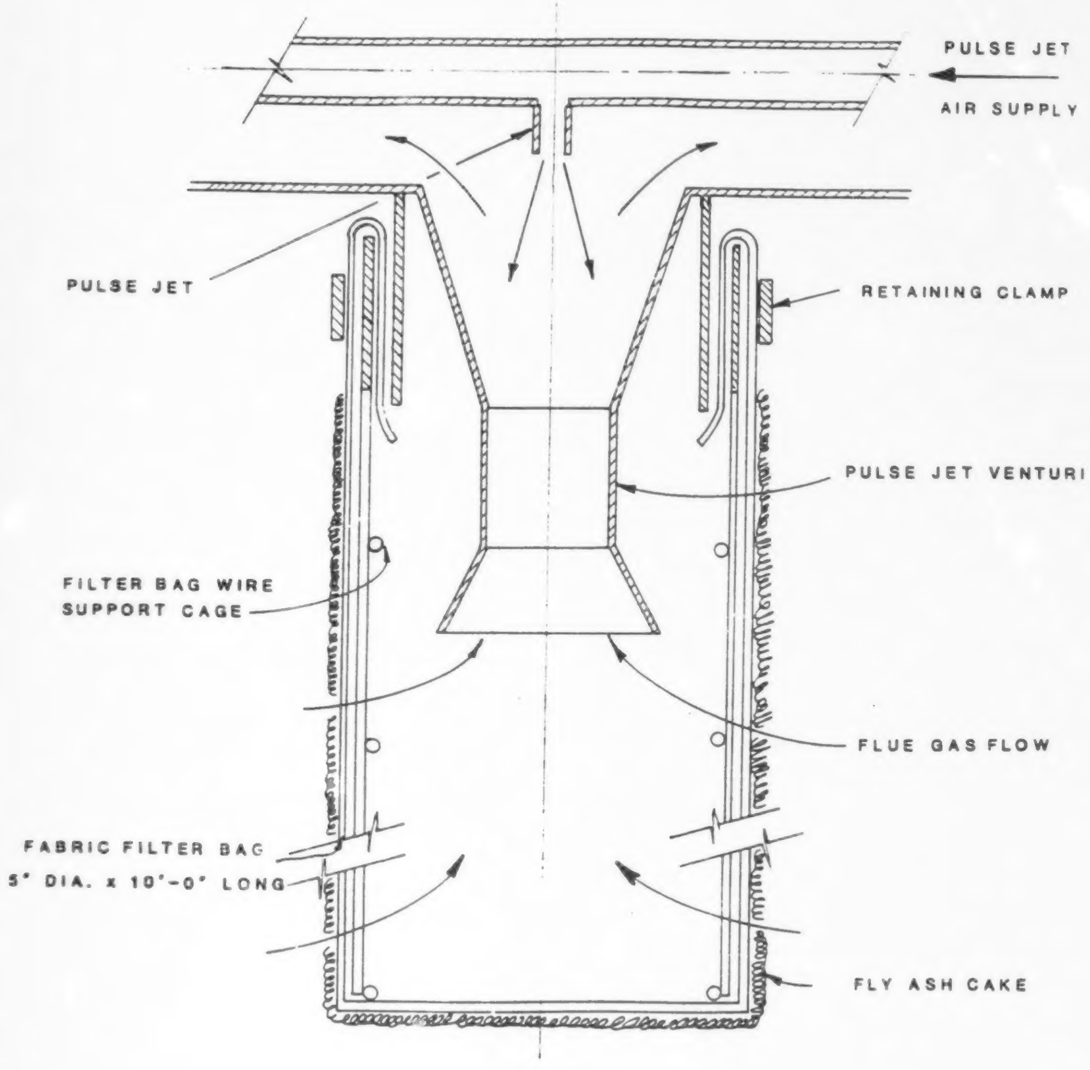

PULSE JET
AIR SUPPLY
PULSE JET
RETAINING CLAMP
PULSE JET VENTURI
FILTER BAG WIRE
SUPPORT CAGE
FLUE GAS FLOW
FABRIC FILTER BAG
5" DIA. x 10'-0" LONG
FLY ASH CAKE

DIAGRAM OF FILTER BAG, TOP CONNECTION AND PULSE CLEANING JET

FIG.13.2

The only way this can be done, because as soon as the baghouse fan is started oily flue gas will be drawn through the baghouse.

Therefore the lime inlet nozzle must be fully open (see fig.13.1), and the inlet damper to the baghouse only partly opened, and immediately after an air/gas flow has been established the lime must be poured into the inlet plenum so that it is deposited on to the filter bags.

An alternative method would be to have an air inlet louvre in the side of the inlet plenum to the baghouse but, cold damp air may be just as harmful to the filter bags as a small amount of oily flue gas.

Once the baghouse is in service and the bags have been coated with lime the CWF guns can be brought into service.

13.2.4. Burning with a Mixture of Fuel Oil and CWF

This is just a continuation of item 2 but immediately after the filter bags have been cleaned they must be recoated with lime. In fact, if any signs have been noted of the filter bags starting to "blind", the addition of the lime should be started while the filter bags are being cleaned and extra lime used after cleaning has been completed.

For the length of time required for cleaning the bags see Table 12.3 and item 13.2.11.

13.2.5. Before Switching to 100% C.W.F

Nothing needs to be done with the baghouse before switching from fuel oil or mixed firing to C.W.F firing, but once stable CWF fires have been obtained without any support from fuel oil the bags should be cleaned and no lime added.

13.2.6 100% C.W.F Firing

At the present state of development of the technology for the burning of C.W.F it is unlikely that a cold start-up would be made with only C.W.F. Even if this was done, light oil ignitors would be required until stable C.W.F. flames had been obtained. Therefore, the filter bags would have to be protected from the oily particulate from the light oil ignitor flames, so pre-coating of the filter bags would be required.

Once stable C.W.F. fires had been obtained and the light fuel oil ignitors removed no more lime would be required, even after cleaning of the filter bags.

13.2.7. Before bringing Fuel Oil Burners back into Service

Before the burning of fuel oil is resumed the fly ash buildup on the filter bags should be checked. This build up is determined by pressure drop across the baghouse. If the filter bags are clean, or have very little buildup (less than ½" wg), the filter bags should be coated with lime before switching to fuel oil. If this switch to fuel oil has to be made quickly without any prior notice, then the lime coating of the filter bags must be done as soon as possible after the switch has been completed.

But if there is a good cake of fly ash on the filter bags, this will protect the fabric from the oil fly ash and liming will only be done after filter bag cleaning, as covered in item 1.

13.2.8. Burning with a Mixture of Fuel Oil Firing and C.W.F. Firing

This is the same as item 3, because the sequence of the fuels are brought into service is not important so long as clean bags are protected with either lime or a cake of coal fly ash before fuel oil firing is started.

13.2.9. Rate of Buildup of Fly Ash on the Filter Bags

The pressures are continuously monitored at both the inlet and discharge of the baghouse (see fig. 13.1) and from these readings the change in pressure drop across the baghouse can be determined. Therefore as the fly ash cake builds up on the filter bags, the resistance to the flow of the flue gas through the baghouse is increased. This shows up as an increase in the pressure drop.

The rate of the fly ash build will depend upon:

- the fabric the filter bags are made of (in Chatham three different filter bag fabrics were tested).
- the ash content of the fuel.
- how complete the combustion of the fuel is.
- how well the fuel is atomized. For example, if the atomization is poor, large droplets will be formed which will fall to the floor of the boiler, whereas fine atomization will form very small droplets which will be carried right through the boiler into the baghouse if there is not sufficient residence time within the boiler for complete combustion of the fuel.

For the rates of buildup experienced at the Chatham demonstration see Tables 12.1 and 12.1.

13.2.10. When to Clean the Filter Bags (ie. remove the fly ash)

This will depend upon the baghouse manufacturers recommendation. In the case of the unit used for the Chatham demonstration, the recommendation was to allow the pressure drop to build up to six inches water gauge (6" Wg) before cleaning the filter bags and the time required to reach this level is covered in Table 12.1.

13.2.11. Time Required to Clean the Filter Bags

The baghouse used for the Chatham demonstration could be cleaned while it was in service, because of the design of the pulse jet used to knock the fly ash from the bags. Whereas on some other designs the baghouse would be divided into four sections, with one section being removed from service at a time for cleaning. This type of unit must be oversized by one third, ie. three of the four sections would have to be able to carry the full load.

Depending on the fabric the filter bags were made from, (at Chatham three different fabrics were tested) the time required for removal of the fly ash was two to five minutes and the filter bags had to be cleaned every two to three hours, see Table 12.3.

13.2.12. Re-coating of Filter Bags with Lime

On the Chatham demonstration this was a simple manual operation, and due to the short duration of the demonstration there was no need to automate the operation.

The quantity of lime required was covered in item 13.2.1 and the lime was just poured into the inlet plenum of the baghouse as shown in fig. 13.1. The whole manual operation only took a few minutes and could very easily be automated.

13.2.13 Automatic Operation

Once sufficient experience has been gained with operating the baghouse manually, while burning different fuels, a reference will be established as to the actual time required for the fly ash cake to build up to the acceptable maximum pressure drop.

It should be noted that most of the fly ash capture is done by the fly ash cakes on the filter bags, and not by the fabric of the filter bags, therefore there is no advantage to continually clean the filter bags. The filter bags should only be cleaned when the cake (the fly ash buildup) reaches the maximum acceptable pressure drop, as once this point has been reached the flue gas flow through the baghouse will start to drop.)

By keeping the cleaning cycles to a minimum, the number of times the filter bags have to be coated with lime, will be reduced as the lime is only used to protect the filter fabric from sticky fuel oil fly ash before the coal fly ash cake is re-established after cleaning.

Another use for adding lime to fly ash in the baghouse would be to help balance the "pH" level of the fly ash to protect both the bag fabric and metal parts of the baghouse. As the fuel used for this demonstration had a low sulphur content the use of lime to balance the "pH" level was not investigated.

These points have been covered to show that it is neither necessary nor desirable to continually clean the filter bags and the prefered method is only to clean when the maximum acceptable pressure drop has been reached.

The timing of the cleaning cycle can be controlled by either of two methods:-

- a pre-determined time period.
- the maximum allowable pressure drop.

The frequency of the cleaning cycles must be determined so the lime requirements can be determined.

The filter bag cleaning and lime addition must be synchronized, so that the filter bag fabric is protected as soon as the filter bags have been cleaned when fuel oil is being burnt.

Therefore if an automatic operation is going to be set up the following five points must be adhered to:

a) - keep the number of cleaning cycles to a minimum.

b) - maintain a good fly ash cake on the filter bags as long as possible.

c) - only clean when the predetermined maximum pressure drop level has been reached, at Chatham this was 6" Wg.

d) - while the baghouse is in operation do not over clean the filter bags, just remove enough fly ash to drop the pressure to the predetermined minimum level. On the Chatham demonstration, this level was 2 to 2.5" Wg.

e) - synchronize the lime addition with the filter bag cleaning and the fuel oil burning.

Note: on a manual operation these points must also be followed.

13.2.14. Continuous Operation

Whether an automatic, or manual operation is being used for continuous baghouse operation an alarm should be used to give a warning if the maximum acceptable pressure drop is exceeded. The reason for this is the efficiency of the baghouse will drop off if the pressure drop is allowed to get too high because this will cause a reduction in the flue gas flow through the baghouse. Also this increased pressure drop could have an adverse effect on the boiler operation. Further, if the fly ash cake is allowed to build up too much, it could become too heavy for the filter bags to support, which may cause them to fail.

13.2.15. Removal of Fly Ash from Hopper below Filter Bags

The baghouse is run at a negative pressure so that the flue gas is drawn through the filter bags, therefore a seal must be maintained at the discharge of the collection hopper (see fig. 13.1).

This can be done in two ways:

a) a rotary valve, which can be either run continuously, or for a few minutes after the filter bags have been cleaned. This type of valve will maintain a seal at the discharge of the hopper while allowing the removal of the fly ash.

This valve would be preferable if it is to be run continuously so that there is no build up of the fly ash in the hopper, and the fly ash will flow out under gravity.

b) the second type of valve would be a knife gate valve, which would only operate after the bags have been cleaned, and it had been found the fly ash would not flow out easily under gravity and must be forced out.

Note: it has been shown even fuel oil fly ash will flow well if it is kept warm, above 300°F (150°C).

13.2.16. Preparation for shutting down the Baghouse

While the boiler is in operation nothing needs to be done to the baghouse to prepare it for being taken out of operation. The baghouse should be equipped with a bypass duct so that the flue gas can be directed around the baghouse at any time. If this is done while burning coal water fuel the environmental standards will not be met, but during fuel oil burning the baghouse may not be required, as as covered in item 2.

13.2.17. Shutdown - Short Term

If the baghouse is only going to be out of service for a short time, up to 3 or 4 days, the filter bags can be cleaned by running the baghouse I.D. fan for a few minutes after the boiler has been shutdown, and going through the normal on-line cleaning cycle. This should be followed by coating the filter bags with lime, because on start up at least the light fuel oil ignitors will be used as covered in item 13.2.6.

The baghouse should be kept warm above the dew point of any oil or sulphur in the unit, about 300°F (150°C).

13.2.18. Shutdown - Long Term

If the baghouse is going to be out of service for some time the filter bags must be well cleaned. This is done by off-line cleaning without the baghouse I.D. fan in service, after the boiler has been shut down. The cleaning cycle is kept in service for up to twenty minutes. The filter bags should also be inspected to ensure all the fly ash has been removed. This inspection can be carried out by removing the access doors to the baghouse.

Once all the fly ash has been removed, the filter bags can be coated with lime by running baghouse I.D. fan as in item 1.

The baghouse should be kept warm about 70°F (20°C) to keep the lime dry.

13.2.19. Filter Bag Failure - Blinding of Filter Bags

There are two types of filter bag failures;

- Blinding of the filter bags
- Rupture of the filter bags

Blinding of the filter bags is a condition when the filter bag fabric becomes plugged and the normal compressed air pulse jet cleaning will not remove the particles that have plugged the air passages through the fabric, or a solid cake has formed over the filter bags.

The filter bag "blinding" will be shown by the pressure drop across the baghouse not decreasing after the cleaning cycle. The first method to try and overcome this would be extend the cleaning cycle, and if possible increase the pressure of the pulse jet air. Some fabrics are limited in the air pressure they can handle. For example the pulse jet cleaning air pressure at Chatham had to be limited to 50 psi on the fiberglass filter bags.

If the filter bags can not be cleaned on-line, the baghouse will have to be taken out of service, and the filter bags removed for cleaning or replacement.

The reason for the blinding should be investigated as both oil and moisture can cause blinding of the filter bags.

13.2.20. Filter Bag Failure - Rupture of a Filter Bag

This is the second type of filter bag failure, and will be shown up by the pressure drop across the baghouse dropping below the normal minimum level. Also the pressure drop across the baghouse will not increase while it is in operation. Further, if a number of filter bags have failed the opacity reading of the flue gas leaving the boiler stack will increase.

If these conditions are encountered the baghouse must be taken out of service and the filter bags inspected. The problem could be as simple as one or more filter bags separating from their retaining collar (see fig. 13.2), but if the filter bags have holes in them they must be replaced. If spare filter bags are not available, and only one or two filter bags have failed, the hole in the bag mounting collar could be temporary plugged and the baghouse returned to service.

The reason for this type of filter bag failure should be investigated as there are a number of reasons for the filter bags to rupture.

- the pulse jet air pressure is too high.
- the flue gas temperature is too high for filter bag fabric. (this type of failure was experienced during the Chatham demonstration)
- acid damage to the filter bags caused by a reaction between the fly ash and filter bag fabric, ie, the acid in the fly ash could damage the bag fabric.
- the fly ash cake was too heavy for the filter bags to support.
- the filter bag retaining clamp was not installed correctly, allowing the filter bag to be pulled away from the support collar.

14.0 ENVIRONMENTAL

Although the pilot baghouse used for this demonstration only had a capacity of equal to one third of the flue gas flow from the Unit No. 1 boiler, when it was put into service the opacity reading of the flue gas dropped from 30% to 20%. This was before a cake of flue ash had built up on the filter bags, which would improve the fly ash collection of the unit. The opacity was read in the Unit No. 1 boiler breeching down stream of the point when the flue gas from the baghouse is returned to the breeching. (see fig. 12.1)

The opacity reading of the flue gas when burning only fuel oil was in the order of 3 to 5%. This was when the baghouse was not in service and all the flue gas passed through the breeching. The baghouse would only be necessary when the flue gas opacity approaches 20%. When any C.W.F. is fired, whether on its own, or in conjunction with fuel oil, some form of duct collection is required.

15.0 Conclusions

The objectives of the pilot baghouse demonstration was to:

- reduce the opacity of the flue gas from the Chatham T.G. Station when burning C.W.F.
- obtain performance data on different filter bag fabrics.
- establish a procedure when burning fuel oil, CWF or combination of both and when switching between these fuels.

All the objectives have been met:

- The opacity was reduced, so that tests could be conducted with the new and larger NRC gun/atomizer, and the EMR burner modifications could also be evaluated.
- Three filter bag fabrics were tested. The polyester fabric failed during the demonstration, even when it was subjected to no higher temperature than that specified by the manufacturer as its upper limit. The two other fabrics performed well but the Nomex cleaned more ready than the fiberglass when on-line cleaning was used.
- In section 13 of the report a detailed discussion has been prepared on how to operate a baghouse when burning the fuel used during this demonstration. It was shown that if the filter bags are well protected by either a coating of lime or a cake of coal fly ash, flue gas from fuel oil burning can be cleaned by the use of a baghouse.
- This demonstration showed that combined firing of CWF and heavy fuel oil can be handled by a baghouse, and during this short demonstration the Nomex fabric was the better of the three fabrics tested.

PILOT BAGHOUSE DEMONSTRATION

AT

N.B. POWER CHATHAM T.G. STATION

SECTION 16 - APPENDIX

SECTION	TITLE
16.1	Baghouse Manual (supplied by Manufacturer)
16.2	Site Reports covering Demonstration: Week of February 17 to 21, 1986 Week of February 24 to 28, 1986 Week of March 3 to 8, 1986 Project Meeting - March 12, 1986
16.3	Site Report from MBB, dated March 13, 1986
16.4	Report from R.P.C. covering: The Examination and Testing of The Filter Bag Fabric, dated March 25, 1986
16.5	Report from NRC covering: The Examination of The Filter Bag Fabric, dated April 16, 1986
16.6	Project Schedule
16.7	Major Purchase Orders

PILOT BAGHOUSE DEMONSTRATION

AT

N.B. POWER'S CHATHAM T.G. STATION

APPENDIX

SECTION - 16.1

Dust Collector (Baghouse) Manual,
supplied by Manufacturer

File: CWF 5 [illegible]
C[illegible] [illegible] Development
CHATHAM BAGHOUSE TEST
Date: 3 DEC 85

INSTRUCTION MANUAL

FOR:	New Brunswick Electric Power Commission Chatham, New Brunswick
EQUIPMENT:	Fabric Filter Dust Collectors
MODEL:	SNF70-13 (3 units)
SUPPLIER:	Air Correction Canada Division Space-Off Products Limited, 282 Belfield Road, Rexdale, Ontario M9W 1H5 Telephone # 416-675-1549 Telex # 06-989229
REFERENCE:	Pilot Test Unit CWF 4/NRC

PULSE TYPE FABRIC FILTER COLLECTORS

HOW THEY WORK

Pulse type collectors from Air Correction Division of Space-Off Products, are installed in line with dust-laden gas streams. As air enters the filter chamber, its velocity is immediately reduced, causing some of the larger particles to drop to the bottom for discharge. The remaining particles in suspension are carried upward to the filter media.

The air passes through the fabric bags while suspended particles are filtered out. The filtered air is discharged into the clean air plenum and, finally, is exhausted out of the system.

The accumulation of dust that cakes on the outside of the filter bag is removed by channeling a blast of compressed air through a precision-made, high pressure venturi suspended in the top of the filter bag. This momentary jet of air floods the bag, creating a shock wave that dislodges the particles for removal from the system.

The entire particle removal sequence takes less than 1/10 second and is automatically programmed through a series of valves. No operating personnel are required.

ECONOMICAL, RELIABLE OPERATION

Pulse type fabric filters have no internal moving parts. This means maintenance is at a minimum. Because the system remains on-stream during bag cleaning, there are no shutdowns or loss of filter efficiency while collected material is removed. Efficiencies of 99.9% or higher may be achieved under proper operating and installation conditions.

Air Correction fabric collectors are custom designed based on years of experience in air pollution control. Insulation, air-to-cloth ratio, flow patterns, filter media and construction materials are matched to the job. Units are factory assembled to make installation on the job site rapid and economical.

Pulse type fabric collectors handle heavier dust loads than other types of fabric collectors and are more compact, so less installation space is required. Platforms, protective coatings, explosions relief and fire extinguishing systems are some of the design variations available.

AIR CORRECTION CANADA

REVERSE PULSE DUST COLLECTORS

OPERATING INSTRUCTIONS

RECEIVING YOUR UNIT

Prior to accepting shipment care must be taken to inspect all equipment received both for proper count and damage. Any and all irregularities must be noted on carrier's copy of the shipping receipt to assist in settling any claims for damage or shortages. All equipment is shipped FOB point of origin, whether on a prepaid or collect basis.

ANY CLAIM FOR DAMAGE IN TRANSIT OR SHORTAGES MUST BE BROUGHT AGAINST THE CARRIER BY THE PURCHASER.

INSPECTION OF UNIT

Housing: Particular attention should be paid to the sheet metal housing of your collector. Unit should be inspected for dents and cracks or rips. Dented housing may seriously affect the structural integrity of the unit. Unit should be checked against the certified drawings for correctness and the manufacturer notified immediately. No corrections may be made without authority of the manufacturer.

Components: A count should be made of all pieces received, and this should be verified against the carrier's manifest. Boxes should be inspected for rough handling which may have resulted in hidden damage.

SETTING UP YOUR UNIT

Housing: Lifting lugs are normally provided for your convenience in handling the dust collector. If these cannot be used, proper care must be taken to assure safe moving and precautions taken to prevent damage to the housing or components.

Electrical: A 120v 60 cycle circuit is required to operate the collector's programming device. This timer must be wired according to the wiring diagrams and provided with a circuit free from transient currents. Do not overfuse.

Compressed Air: All compressed air piping leading to the collector must be purged prior to hooking up to the distribution header located on the unit. 90-100 PSIG of clean, dry, oilless air is required for your unit to operate properly. If excessive moisture is present an after cooler and dessicant dry is strongly recommended.

Assembly of Filters into housing: Pull the bag over the cage tightly and tuck the top end over the split band and down into the cage. Smooth out wrinkles inside split band. The cage is then slid over the venturi and the bead on the split ring snapped into the groove on the venturi. A tridon gear clamp is then tightened around the bag and cage assembly directly over the bead and groove to hold the assembled unit in place.

Doors: Hold-downs on doors should only be hand tightened. Excessive pressure can distort the door panel itself resulting in leakage.

Auxiliary Equipment: All auxiliary equipment must be installed according to manufacturer's specifications and interlocked with the entire system as needed. Direction of rotation of each item should be checked prior to start up of the entire system.

Valves and Piping: After unit has been installed diaphragm valves should be checked to make sure port marked "IN" is assembled to the distribution header. The "IN" connection of the solenoid valve is connected to the diaphragm valve by means of some 1/4" tubing. Each nut on the compression fittings should be checked for tightness before the distribution header is pressurized.

START UP INSTRUCTIONS

Check air pressure available verify 90-100 PSIG.

Check pressure differential gauge to make sure that high pressure tap is connected below the tube sheet and the low pressure tap is above the tube sheet. Verify that the gauge has been zeroed.

Apply current to timer and make sure the timer is cycling. A jumper plug on the model 1049 timer board enables selection of from 2 to 10 solenoid valve hookups. When all components are running properly the dust laden air may be started through the collector. At this time the manometer or differential gauge should be observed. The gauge should over a period of time, move slowly up until it stabilizes somewhere between 3" and 5" of water differential. If the gauge does not level out, but continues to climb to 7" and more, the timer should be shut off and the adjusting ("OFF TIME") screw should be reset to provide the minimum 3 sec. off time. Re-energize the timer and observe the pressure drop. The gauge should drop slowly after each pulse and level off between 3" and 5". If the differential gauge drops below 3" or has leveled out at considerably less than 3" the "OFF-TIME" should be increased until the collector stabilizes at any point between 3" and 5". Refer to trouble shooting for further information.

NOTE: If a manometer using a fluid of a specific gravity other than 1.0 is used, the proper corrections should be made.

NOTE: When venting gas or oil fired equipment care must be taken to have the blower interlocked in such a way to assure the blower operation to continue for an adequate period of time to purge any unburned gases from the collector prior to start up of any burners. The installation of a gas detection and temperature limiting devices should be investigated and installed when found necessary.

TROUBLE SHOOTING

1. Excessive Pressure Drop
   a. Check air pressure in header.
   b. Check timer to see if it is functioning properly. Decrease "OFF" time to 3 sec. and repeat instructions described under the "START UP INSTRUCTIONS".

c. Clean out differential pressure gauge or manometer lines by blowing compressed air through the lines.
d. Check solenoid valves to see if they are operating properly.
e. Check for loose wiring.
f. Check for moisture or oil in air lines. Check to see if upper part of filter bags are damp or caked up. Install "after-cooler" following the compressor and automatic moisture drains on receiver, and provide moisture traps or dessicant type dryer at collector if moisture is present.
g. Check dew point of dust laden air. If unit is at or below dew point it may be necessary to pre-heat collector with hot, dry gas before start-up and/or to insulate collector. If heavy moisture condenses on the bags at shut-down then the collector must be purged with hot, dry gas before final shut-down.
h. Run timer and compressed air jets with main fan off for 15 to 30 minutes. Start fan (with no dust load) and run for 15 more minutes, observing pressure drop across bags. If bags do not "clean down" to or below the following readings and the pressure drop climbs rapidly with the dust load "on" then the bags are either 1) blinded with too much dust or 2) caked or set-up with moisture laden dust. Most types of dust can be removed by special dry cleaning.

AIR TO CLOTH RATIO	MAX. PRESSURE DROP WITH CLEAN BAGS AND NO DUST LOADING
5/1	.9"
10/1	1.5"
15/1	2.0"

i. Check main air flow volume with pitot tube or equivalent measuring equipment and compare with original air volumes for which unit was designed.
j. Check dust particle size and dustloading in air stream and compare to design specifications. Particle sizes below 10 microns have greatest effect on pressure drop.
k. Check if bags are "skin" tight on cages. Bags must be free on cage for proper "Flex". Bags which have been cleaned or washed may shrink and must be checked for a "loose" fit.
l. Check hopper for overloading.
    1. Check dust discharge mechanism for proper operation and capacity. Correct if necessary. Do not use the hopper for storage of material, unless the collector has been designed for this function.

    2. Check for material bridging across hopper or sticking to hopper. Coat hopper with Teflon type material or add a sufficient size rapper or vibrator to keep hopper clear.

2. Extremely Low Pressure Drop

a. Clean out differential pressure gauge or manometer lines.
b. Check for holes in bags or worn bags and replace if necessary.
c. Check to make sure bags are installed properly (see bag installation for instructions).

3. Secondary Dusting - Primary Dusting

   a. Allow unit to run at least 48 to 96 hours after initial installation of bags before performing checks. This running time allows bags to reach their operating efficiency and dusting may stop.
   b. Check filter bags for holes and wearing, replace if necessary.
   c. Check bag installation.

4. Poor Bag Life

   a. Check operating temperature to see that it is within limites of your bag material.
   b. Check ph of dust to see if you have proper filter bags for conditions.
   c. Check filter ratio vs. original specifications. Excessively high ratio will shortin bag life.
   d. Check for moisture and dew point in unit. High moisture will cause certain filter materials to shrink and shorten bag life.
   e. If localized abrasion of bags is observed an impingement baffle may be required.
   f. Check for corrosion on cages. "Rough" surfaces will cause excess bag wear. Plastic coated or 304LSS cages are available.

If you are experiencing any difficulties not covered by the above instructions contact your local representative or the manufacturer directly.

File: C.W.B.E. Chatham
Coal/Water Burner Development
Chatham - [illegible]
Date: 20 JAN. 81

8.1 OPERATION OF BAGHOUSE SYSTEM

Like any new equipment, the filter system has a start-up period which can last a few minutes or many months, depending in part on how well the system was planned. Afterward the system functions with much less attention. It is important to remember, however, that any change in the input conditions will make at least some difference in the filter's operation and require a period of special attention.

8.1.1 Start-up

When the new equipment is started for the first time, the fan should be checked for correct direction of rotation and speed. The ducting, collector housing, etc. should be checked for leaks. Gas flows and pressures should be checked against the design specifications. Instruments should then be checked for correct reading and calibration adjustments made as necessary. Control mechanisms, and especially all fail-safe devices, should be checked for operability.

At the first start-up of the system, and also whenever new bags have been installed by the maintenance crew, the bags should be checked after a few hours of operation for correct tension, leaks, and expected pressure differential. Initial temperature changes or the cleaning cycle can pull loose or burst a bag. It is wise to record at least the basic instrument readings during this start-up period on new bags for ready reference and comparison during later start-ups.

It is not always specified, but it is generally a good idea to start a new set of bags at a filter velocity lower than that to be normally used. The reason for this is that new bags have a low flow resistance, and if the fan is run at normal speed with no other flow resistance in the system, the filter velocity will at first be quite high. As a result the efficiency will tend to be low and dust particles may be driven into and plug the cloth. In contrast, a low initial velocity will allow the first dust particles to stay closer to the surface of the cloth, bridging over the [illegible] in the cloth and leaving the rest of it much more permeable. Then the velocity can be gradually increased until, after a small [illegible] of dust cake has formed, the normal filtering velocity [illegible]

In addition, when removal of the dust cake must be unusually thorough during every cleaning cycle, it may be worthwhile to begin filtering at a lowered velocity at every cycle. This can be done manually by gradually adjusting a blast gate, or if the procedure must be done frequently or if precise control is needed, it can be accomplished via automatic control equipment. Some filter equipment is specifically designed for this.

During any start-up, transients in the dust generating process and surges to the filter house are probable and ought to be anticipated. Unexpected temperature, pressure, or moisture has often badly damaged a new installation. In particular, running almost any indoor air or combustion gases into a cold filter can cause condensation on the walls and cloth, leading to blinding and corrosion. Condensation in the filterhouse may void the manufacturer's guarantee. It can be avoided by preheating the filter or the gas.

8.1.2 Routine Operation

Day-to-day use of a filter system requires frequent observation and occasional adjustments in order to determine and adhere to the best overall compromise between performance, bag life, power costs, etc.

8.1.2.1 Use of Instruments - A single monometer used across the filter cloth can provide a wealth of information. It indicates the permeability of the cloth, tells how heavy the dust deposit is before cleaning, how complete the cleaning is, and whether the cloth is starting to plug or blind. It tells what surges in velocity the dust deposit is undergoing, and whether there is any flow through the cloth during the cleaning cycle.

It is a good idea to post a list or a recording of the normal differential pressures through one filtration cycle, as a means to quick detection of later trouble. A high differential may mean:[1]

- an increase of air flow
- the beginning of blinding of the cloth
- hoppers so full as to block off the bags
- condensation in the cloth
- cleaning mechanism inoperative

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[illegible] low differential pressure may mean:

- the fan is slowing down, perhaps due to belt slippage or fan motor problems
- broken or unclamped bags
- plugged inlet ducting or valves closed
- leakage between sections of the filterhouse

The reading of the manometer should be easily visible from the plant operating floor, and one man should have responsibility for checking it. On an expensive system an alarm should sound if certain pressure differential tolerances are exceeded.

Other instrumentation can be nearly as valuable. If it has been installed it is probably there for a good reason and it should be used. Transients frequently occur in pressure, flow rate, temperature, and humidity. Operating personnel should know at once when an indication is excessive and what the causes may be. A trouble-shooting manual, as shown in Appendix 8-1, should be kept handy to the filterhouse.

8.1.2.2 Flow Variations - With multiple or variable dust [illegible] points there will be variations in flow rate and filtering velocity. All the branches of the inlet ducting may be open or some may be shut off, depending on plant activity. Also while one collector compartment is down for its cleaning cycle, another may be down for bag changes or still another for inspection. These system changes affect the flow through the filter. Too much flow through too few bags amounts to an overload or too high a filter velocity, leading to inefficient filtering, plugging of the cloth, loosening or bursting of the bags, or unsatisfactory building ventilation. Too low a flow is a frequent cause of condensation. When flow variations are anticipated, it is wise to have at least manual means of flow control, and automatic control equipment is often justified.

8.1.2.3 Cleaning Cycle - As the cloth ages, adjustments in the cleaning cycle may be advisable either in the amount or the intensity of cleaning or in the length of the cleaning cycle. One tries to use as little cleaning as possible so as to prolong the life of the [illegible] one has to use enough cleaning to keep the differential pressure economic level. There is in principle a point of optimization, although this may be difficult to locate in practice. Operating at the point of minimum cleaning is indicated by a gradual build-up of differential pressure, perhaps over a period as long as a few days. Then before the pressure gets too high, a slight increase in cleaning action (frequency or intensity or duration, as appropriate) should reverse the trend in pressure. After a few cycles or a few hours the pressure should reach a sufficiently low level to reduce the cleaning action. If this gradual fluctuation in differential pressure is not observed, it may mean that the fabric is being overcleaned, because the only way to be sure the filter operation is near the point of minimum cleaning is to continually operate around it. Changes in process or fabric condition will undoubtedly cause the cleaning requirements to shift from week to week, requiring a continual hunting for them. Normally the process will be sufficiently stable through automatic control so that day to day observation and adjustment of the cleaning cycle can be made manually by a skilled person in a few moments. This procedure of hunting for the minimum cleaning requirement is normally worthwhile on all except possibly the smallest filter systems.

8.1.2.4 Changes in Operation - The fiber is carefully designed to operate with a certain flow rate, particle size and type, etc., and any changes in these conditions, expected to exceed ten percent or so, should be analyzed for their effect on the overall filter operation. This should be an economic analysis by an engineer skilled in fabric filter systems. If large changes are indicated or a large installation investment is involved, a short pilot study using, if necessary, borrowed pilot filter equipment may be justified.

8.1.3 Shut-downs

The main precaution in shutting down the filter system is prevention of moisture in the filterhouse. Condensation can appear through the cooling of gases containing moisture, particularly combustion gases, if they are not completely purged from the filter system and replaced with drier air before the filter cools down. This can also happen with air at ambient moisture levels if the filter is in a colder location. It can happen if weather leaks into the collector particularly during extended shut-down periods. To prevent condensation some plants purge their systems carefully on shut-down and then seal the system off completely. Others continue a flow of warm air through the filter during the shutdown, which also helps prevent condensation when they start up again. A partially sealed-off filter system can be lightly pressurized with reasonably dry air to exclude seepage of damp air.

In addition to general maintenance during shutdowns, other reported practices include cleaning corners and crevices of any dust accumulations which might solidify during a prolonged shutdown; removal of any material which might catch fire on contact with air;and removal of the bags for storage under more suitable conditions.

8.1.4 Safety

The preceding portions of this chapter mention a number of precautions against system damage. There are of course any number of possible accidents. Baghouse structures and ducting are usually adequate to prevent metal fatigue or panel collapse during normal pressure excursions. It may, however, be less expensive to include explosion panels than to design the entire system to withstand a large surge of pressure. A surprisingly large number of dusts are flammable and some are spontaneously combustible. (A good test is to ignite a small conical pile of the dust and observe the rate and amount of burning.) The danger of fire in a high velocity air system containing cloth is apparent. Some plants find that their ventilating hoods collect a surprising quantity of combustible material like lunch bags and candy wrappers. Instrumentation responding quickly to sudden temperature changes, such as an automatic cooling system, may be justified in some installations.

Operating personnel should be accustomed to think "Hazard!" whenever a fabric filter is being used on abrasive dust or toxic fumes or gases. (Many dusts have some degree of abrasiveness which can make trouble in other plant equipment unless controlled.) Safety codes in such cases will not normally permit the recirculation of the filtered to the building but if the air is recirculated, any bag failure can be serious. If the exhaust is to the outdoors then consideration has to be given to providing make-up air for ventilation to the building, as no sizable exhaust rate can be made up by leaks through doors and windows. At times the closing of windows or doors may cut down the air flow through the building so much that the dust pick-up hoods fail to ventilate adequately. In certain weather the makeup air inlet may entrain some of the outdoor exhausted gases unless precautions are taken.

The disposal of collected dust can be a problem. If the dust is poured or stirred in the open or if there are leaks in the disposal equipment some of the material will re-aerosolize; it does not take much dust escape (~0.1 percent!) to offset the remarkably high efficiency of the fabric filter. The procedures needed for disposal of radioactive dust can use up the permissible exposure quotas of many men unless carefully planned.

8.2 MAINTENANCE OF BAGHOUSE SYSTEM

There is a wide tendency to regard the dust collector as a piece of trivial equipment until something goes wrong with it, whereupon it becomes despised as a troublemaker. Planned preventive maintenance is a better policy, the amount depending on how much the plant has to lose in case of a system failure. A few companies successfully contract out the dust collector maintenance, some contracting the entire job and others only the supervisory portion, leaving the routine maintenance to in-house men.

Timing of maintenance is important. A supervisor or maintenance forman may spend two hours every day looking over a large system, because to let things go any longer than this is, in his experience, inviting trouble. For example, one leaky bag can rapidly destroy the adjacent bags unless detected. Other procedures may be best done once a month, or every six months, depending on what they are.

Maintenance procedures will be based on the operating and maintenance manuals furnished with most fabric filter equipment, and later they will be supplemented by experience. Appendix 8.1 lists examples of maintenance procedures and troubleshooting lists extracted from several such manufacturers' manuals. Records of bag changes as well as non-routine maintenance may prove invaluable later in pinpointing high-cost parts of the collector system and for projecting costs of any proposed similar equipment.

In the following paragraphs maintenance practices are suggested for the various parts of the system. While these are extracted from reports of over 100 specific installations, some comments regarding equipment apply generally. The one factor most responsible for high maintenance costs seems to be excessive filter velocities. Another factor is location; centrally located equipment receives more attention than isolated, inaccessible equipment and as a result often gives better performance. Similarly a single large system has fewer servicing points than a number of small dust collectors and will cost less to maintain, other things being equal.

The system components should all be readily accessible. Ladders, walkways, and cranes necessary for maintenance should be provided at the time of installation. Lighting outside and if possible inside the filterhouse should be installed. If the equipment is outdoors it should be especially well protected, and the hoppers, disposal equipment and fans should be enclosed to make servicing easier during bad weather. Wherever there is possibility of dust accumulation or plugging there should be access doors or cleaning ports. Doors, valves, bag clamps and tension adjustments should all be serviceable by hand with a minimum of tools, to save time.

8.2.1 Hoods and Collection Points

Check periodically for ill advised changes such as holes cut in the hoods, more hoods added, ducts blocked off, or dust intakes moved away from the dust source. Be sure any temperature sensor located in the gas stream is where it will pick up a temperature truly representative of the mixed gas.

8.2.2 Inlet Ducting

This is a moderately large problem area for several reasons:

(a) Abrasion. Flat, heavy plates installed at bends may increase elbow life. Alternatively soft, rubber-like material may out-last metal.

(b) Corrosion. Insulate to reduce condensation. Ducting made of plywood may be compatible with mildly corrosive gases. Long ducts, such as "hairpin" cooling systems, are particularly subject to corrosion unless condensation is avoided.

(c) Sticking. Some dusts may "paint out" on the inside of the ducts. If this is due to dampness or due to thermal precipitation from hot gas to cold duct, insulation should help. An increase in pressure drop from end to end is an indication of plugging. While vanes in duct turns can minimize pressure losses at the turns, they may collect material.

(d) Settling. Install clean-out doors or air lances in long horizontal runs if there is any danger of settling. Frequent plugging may require a Vee-shaped duct with a conveyor in the bottom of it, or a higher air velocity (i.e., smaller duct) at the expense of an increased pressure drop. If possible keep the bottom of the ducting straight; when tapers are necessary, put them in the sides or top.

(e) Temperature surges. Peaks in gas temperature will not be reduced or dampened appreciably by short lengths of ducting. However, the removal of duct insulation or the addition of a heat absorber like brick work or a steam boiler in the duct system will help to dampen temperature excursions. Otherwise a high-temperature by-pass of the filterhouse or some other variety of fail-safe equipment may be needed.

8.2.3 Blast Gate and Flow Control

Problems with flow control equipment are frequently reported. [illegible] valve which may have abraded, plugged, become moved, etc. should be [illegible]cked periodically. Especially the blast gate should have a positive lock [illegible]inst vibrational moving. It should be accessible, not in a duct high [illegible]rhead, as it may have to be adjusted frequently.

Filter compartment inlet dampers are a high maintenance item and spare parts should be stocked. An indication of a bad damper seal is a differential pressure across the cloth when there is supposed to be no flow through the compartment. This is given as a common reason for short bag life in shake-type systems. The valves on the clean side of the baghouse, if any, may also malfunction if the bags have been allowed to leak extensively and the valves are fouled. Either air cylinders or motor driven actuators for dampers and valves may be used, depending partly on the required speeds of opening and closing. Motor driven actuators, although slower, may be slightly more reliable.

Being able to isolate a compartment from the rest of the system without shutting the system down can be invaluable to baghouse maintenance. However, even the best valves may not be acceptable in all cases; for example if there is danger of carbon monoxide, internal maintenance may be prohibited except during plant shutdowns.

8.2.4 Fans

Fans and blowers are reported to be a large problem area, particularly those located on the dirty side of the baghouse where material can accumulate on the vanes and throw off the balance. Corrosion and abrasion can also cause trouble. It is wise to anticipate and prepare for some fan maintenance in order to avoid long, expensive shutdowns. For example, the fan should have access doors, electric disconnects, and crane facilities for both ease and safety. Fan maintenance is reduced by installing rugged equipment, and a large slow fan will probably need less attention than higher speed equipment. If one type of fan blade does not seem to last very well, another type may be better (see Section 5.[illegible]) Having two or more fans on the system may enable maintenance of one of them without shutting down the system completely. Furthermore, seal maintenance problems on the filterhouse may be reduced by having fans both before and after the baghouse, enabling operating the house at nearly zero gauge pressure. Condensation and corrosion in the fan may be alleviated with duct and fan insulation; most fans come provided with drains in anticipation that water will sooner or later get into the fan housing.

The fan should be checked for direction of rotation periodically, as even a fan running backwards moves some air. Air flow and fan speed should be measured, not just estimated, checking belt wear and adjusting the belt tension as necessary. These checks can be combined with routine lubrication procedures.

Vibration noise probably means the rotor is out of balance, and/or the bearings are going bad. Abrasive or sticky material may easily change the fan blade weight, and the faster the fan speed, the more serious this is. Sometimes a relatively small adjustment in speed can temporarily alleviate a vibration until such time as the fan can be shut down for repair. One remedy for accumulation of material on the blades includes sand-blasting. This is a matter of hours, if the rotor has to be removed, but abrasive blasting systems have been installed in the fan housing to expedite the job.

8.2.5 Entrance Baffles

Good baffling can reduce maintenance in the filterhouse by helping to distribute the gas flow and the dust load more evenly to each compartment and to each bag. A baffle can protect the fabric nearest the compartment inlet from direct impact of abrasive particles, or it can protect the first couple of feet of each filter element from the same thing. Used skillfully, baffles can either direct the largest dust particles downward to the hopper or upward to the filter surfaces, thus in effect controlling the flow resistance of the dust deposit. For any of these purposes it might conceivably be advantageous to use baffles that are manually adjustable. On the other hand, baffles sometimes have to be removed when they contribute to maintenance problems by accumulating dust or abrading too rapidly.

8.2.6 Hoppers

Bridging and backup in hoppers should be anticipated whenever the dust is expected to have a high angle of repose (a steep angle of slide when piled), a low aggregate density, or a high particle length/diameter ratio. Steep-sided and/or wide-bottomed hoppers will presumably have already been installed. Further assistance may be obtained by antifriction coating the hopper surfaces, or by air-pulsed rubber liners in the hoppers. Vibrators are often used to loosen the flow and if used, heavy low-frequency vibration may be preferable. However, some dusts tend to lock up when vibrated, especially when the dust is already deep in the hopper. If surges in dust load are causing back-up, then over-running of the rotary valves will help. Moisture introduced through a leaking rotary valve in a suction system can cause sticking on the hopper walls. If condensation is occurring in the hopper, insulation should help.

Sledge hammering is reported to be one method of freeing a clogged hopper. A better method is the installation of poke holes in the side of the hopper; these can be designed in the original equipment if the need is anticipated. Any hopper will get better attention if it is housed against inclement weather.

8.2.7 Bag Retainment

8.2.7.1 Thimble Sheets - One fairly common complaint is that the bags are packed together so closely as to abrade against each other or against the baghouse. Close bags can neither be inspected adequately nor installed nor adjusted easily. If the bags are more than about three-deep beside the walkway, or two-deep for large bags, the man cannot reach from the walkway to do his job. Hence damage often results as he misplaces his feet. In the event of high maintenance resulting from overcrowded bags, some baghouse users take out part of the bags and block off the thimbles. Unfortunately this overloads the rest of the bags. It would be better to take out the old thimble sheet and seal in a better designed one.

The thimbles themselves are ideally seamless and blunt-lipped to minimize stress points and chafe on the cloth.

8.2.7.2 Fastening - The method of fastening and tensioning bags is one distinction between equipment by different manufacturers, and there are many variations. Generally, a minimum of tools should be needed; clamps should be both quick and finger-adjustable. By the same token, both hands should be free for the work; that is, the man should not have to hang onto a ladder or lean far over as he works on the bag. Fastenings should be secure, because as a taut bag is collapsed it becomes tighter and the fastening tends to slip. Also large changes in baghouse temperature can lead to differential thermal expansion, bag tension changes, and possible slippage. Sometimes a bag pulls completely loose from the thimble, as indicated by a dusty exhaust and an unusually low manometer pressure.

8.2.7.3 Tension - At present there is no general rule for how much tension a bag should have for best overall performance. A very slack bag can fold over at the lower cuff and bridge across or wear rapidly. Too much tightness will damage the cloth and work against the fastenings. Because of the seam, as the tube is tightened it may arc, banana-like, enough to touch the next tube. Whatever tension the bag has when it is installed will be increased by the weight of the dust cake, especially at the top of the bag. This can be an increase of several times the bag weight with some dusts. Circumferential tension as from inflation may further cause the tube to tighten lengthwise. The fabric properties may change as the bag ages, and this may also change the tension. For all these reasons the tension of the cloth needs to be checked from time to time, especially a few hours after installation of the cloth.

Correct tension is mainly a matter of filter dimensions and cleaning mechanism. Shake cleaning in particular seems to require a unique combination of tension, shake frequency, and bag properties for best results. The manufacturer's recommendation should be followed until there is more pertinent experience to go on. One rule for obtaining adequate tension is the two finger method; when two extended fingers are slipped over the uninflated, flattened tube, it is claimed that the wrist should just be able to rotate 90 degrees. This amounts to about one-half inch of slack, not a precise amount but a very ready test. Bags that clean by collapsing may be under the best tension when they take on a cloverleaf pattern as they collapse. Correct tension is reported as being from 25 to 100 pounds for glass bags of one-foot diameter, enough to keep them sufficiently open during cleaning to let the dust fall to the hopper.

8.2.8 Filter Elements

In most filter systems the biggest part of the maintenance program is related to fabric upkeep. The cloth has to be inspected regularly, and it is replaced either on a preventive basis or on short notice as trouble occurs. Some filter users are able to salvage some of the removed filter elements, while others find salvage does not pay. While other parts of the filter system may be maintained by the standard skills found in most plants, filter elements need special handling at all times. Glass fabric, for example, is especially fragile and can be ruined by kneeling on it or dragging a tool across it.

8.2.8.1 Spare Stock - At least a few replacement and usually a complete set of filter elements should be kept on hand, the quantity depending on the expected bag life, the risk, and the delivery time. The margin of safety and risk of shutdown are balanced against the costs of storage and inventory, which are annually about 10 percent of the purchase cost of the fabric stored. The spare filter elements should be labeled to indicate type and quality, clearly enough to avoid any possible confusion with other sizes, cloths, or manufacturers, and kept well separated from used filter elements. Elements are stored safely against mildew, larvae, crushing, etc. usually on a first-in, first-out inventory system.

Filter elements can be purchased either from the equipment manufacturer or from a firm that specializes in sewing various types of filter elements (Section 4.6). On the one hand, it is a good idea to avoid splitting the responsibility for filter system performance between the equipment manufacturer and a separate bag supplier. On the other hand, most filter users feel vulnerable if they are committed to getting all their stock from one source. At least one filter user solves this problem by buying cloth and sewing his own bags. Generally, the experienced firm supplies the most reliable products. Inexpensive filter elements often turn out to require a lot of maintenance and be more expensive in the long run.

8.2.8.2 Installation - In many filter houses the elements can be installed by one man, but in the interest of a short down-time a crew of two or three men usually do the job. (Not all types of equipment have be shut down for bag replacement: see Section 5.2.) Practices differ between keeping old and new elements in separate compartments and mixing them together, which is customary when accidents happen only to a small percentage or when there is no problem about down-time. Keeping them separate is better preventive maintenance, although it is more expensive since some cloth will be discarded before its life is up. Keeping them separate is preferred when filterhouse conditions are noxious, or when entrance to the compartment takes a lot of preparation time. In either method records should be kept showing date of maintenance, a description of the cloth installed, and the location of the change by thimble number or compartment number.

8.2.8.3 Inspection - External maintenance inspection of the filter house and system is usually performed daily, while the filter elements themselves are typically inspected once a week to once a month. The appearance of the air exhausted from the filter is not always a reliable indicator of element condition; the inside of the filterhouse should also be seen.

Any dust on the floor of the clean side of the filterhouse indicates faulty operation, and the location on the floor is often a quick indication of which element has failed. More often, however, locating the hole in the fabric is a difficult, time consuming job, sometimes because the hole is hidden by other elements. Fortunately experience often shows that most of the holes occur in certain repetitive areas of the bags. Holes (or more important, thin places about to become holes) may sometimes be located by running a fluorescent light tube or flashlight through the filter element, perhaps while it is still in the filterhouse. Sometimes on squeezing the bag or tube a puff of dust will show the location of the hole.

It is important to repair holes as soon as possible after they develop, of course, especially when abrasive dust is being filtered, because a hole in one element can quickly cut a hole through the adjacent fabric. If there isn't time to repair or change the perforated bag it should be tied off until such time. The same applies to a seam failure; whatever quick remedy will permit continuing the operation until a downtime can be scheduled.

The inspection procedure at an 80,000 CFM 500°F installation has been described in the literature and may be of interest:[2].

> "At present an inspection of the bags while the baghouse is operating requires a supervisor, the operator, and three mechanics. The operator locks out one compartment at the panel board, one mechanic closes the tipping gate valve at the bottom of the hopper, and the other two mechanics open the top and bottom inspection doors. The supervisor enters the bottom of the compartment, inspects the bags for general appearance, and any defective bags are tied off or capped at the cell plate. The procedure is reversed to put the compartment back in service, and the next compartment is inspected. All 10 compartments may be inspected and serviced in this manner in less than four hours. Inspections are made about once a month. Bags are replaced during furnace rebuilds, when the baghouse is cool."

8.2.8.4 Salvage of Filter Elements - Bags can be removed for cleaning and repair if most of the cloth is still sufficiently valuable. Patches can be sewn on, or sometimes applied with quick-setting glue without removing the bag from the baghouse. Thermosetting and pressure sensitive adhesives have been used to repair glass bags. Of course that portion of the cloth surface patched is lost for filtration, and the surrounding cloth takes a slightly higher load. Bags with holes all in one end can have a new end sewn on.

There are a number of ways of cleaning a removed bag, if this is judged to be worthwhile. Dry methods include turning it inside out and beating or brushing it, tumbling it in a drum, vacuum cleaning it, and using jets of compressed air on it. These techniques may damage the cloth, especially glass cloth. For example, cloths plugged to the point of rigidity may be actually broken by bending them. Wet cleaning methods may be more practicable when a cloth has become blinded or plugged well before its mechanical life is up. In rare cases wet cleaning of the bags inside the filterhouse may succeed. Felts have been dry cleaned successfully. Unspecified cloths were reported to withstand 6 to 8 washings before they had to be thrown away. Consulting the fabric supplier or manufacturer might well salvage a large cloth investment that has met with a partial accident.

It is good practice to install salvaged fabric in separate compartments from new fabric in order to get full service from the new compartments.

8.2.9 Collector Housing

The importance of accessibility has already been discussed: a central location, inclement weather protection, ladders, walks, and lights are all conducive to good maintenance and will reduce maintenance expenses. Also the interior of the collector should be readily accessible, if possible during operation. High temperatures or noxious dusts may make collector entrance hazardous or unpleasant and thus expensive. Respirators, coveralls, gloves, etc. if needed for entrance, should be kept close by for emergency repairs.

Faculty seals are a frequent complaint in collector housings, especially when the equipment has been assembled by an unexperienced crew. lso, seals tend to be weakened by weather, heat and age. Seals should be checked every six months to a year; one technique involves placing one man inside the compartment at night with a light and another man outside. While large leaks may be indicated by a manometer that does not zero when it is supposed to, minor leaks as along a thermocouple wire which can admit water to begin a corrosion problem are harder to find. If necessary, the filterhouse panels and flange connections can be dismantled, cleaned up, and reassembled, probably using both cemented gaskets and bolts. Seals around the doors to the filterhouse must not be overlooked.

The doors should be openable by hand without need of special tools; they should be large enough for easy entrance, fabric maintenance, and periodic cleaning of the dust which inevitably penetrates the cloth to the clean side of the compartment. Glass panels in the doors may be worthwhile for observing the filter elements in operation.

8.2.10 Specific Cleaning Mechanisms

Each of the standard mechanisms (see Section 3.3 and below) requires some maintenance procedures not shared by the others. Generally

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the more elaborate the cleaning apparatus the more maintenance of all types needed. One should use a minimum of cleaning energy; if the cloth fails to clean adequately then a small temporary increase in the cleaning process may bring the pressure drop back into line. The process of blinding tends to be an accelerating one, because as the free area of the cloth decreases the fan pulls harder in attempting to maintain the flow. This increased pressure drop in an already marginal situation must hasten the blinding process. For the maintenance man, this means being alert and ready to adjust the cleaning procedure as necessary. At the same time, however, all changes in cleaning procedure should be fully cleared before they are put into practice, because the cleaning process has far-reaching effects and a large part of the filter system expense is related to the cleaning action.

8.2.10.1 Shake - Any wear in the shaking machinery results in a lessening of the shaking action, and unless the trouble is recognized for what it is, the shaking intensity may be stepped up until the mechanism destroys itself. Regular lubrication and avoidance of gritty dust in the mechanism can best be achieved by having most of the shaker mechanism outside the filterhouse.

If the cloth is not cleaning, check the shaker rack to be sure it is moving. (For doing this while the rest of the filter system is down, a jog button located near the door of the compartment is useful.) A small adjustment of shake amplitude or frequency may markedly change the propagation of the shake wave along the cloth tube and improve the cleaning. If the cloth still won't clean sufficiently with a safe amount of shaking, it may be necessary to reduce the filtration velocity or alter the particulate characteristics for a few hours. The velocity should, of course be absolutely zero or even negative during the shake part of the cleaning cycle.

Fabric wear due to flexing may be a problem; see the comments under "Reverse Flow Plus Collapse" below.

8.2.10.2 Reverse Flow - The reverse current of air has two functions, that of pushing the dust deposit off the cloth, and usually that of flushing the dust into the hopper. The rate of flow (or the back pressure) and the timing need adjustment from time to time to keep the residual drag at an economical level.

8.2.10.3 **Reverse Flow Plus Collapse** - Whenever the cloth is flexed as part of the cleaning process, and wherever it flexes, there is apt to be a high rate of wear indicated by a thinning and eventual perforation of the cloth. This is especially common near the thimbles where the flexing is 3-dimensional. A decrease of air flow or an increase in cloth tension will help to reduce flexing. Frequently cloth flexure is reduced by installing rings inside the tube, sometimes sewing them into the tube. In the cases of reverse pulse and panel filters, wire grids are generally used to back up the cloth. While these do reduce flexure wear, they may also introduce frictional wear between the cloth and the ring or grid.

Note that any type of mechanical wear of the fabric--abrasion, flexure, or tensile wear--will be amplified by adverse environmental conditions. The molecular structure of both synthetic and natural fibers may be damaged by high temperatures, moisture, and/or chemical conditions, thereby weakening the fibers and making them more susceptible to mechanical wear. Thus in a particular case, lowering the filtration temperature may alleviate a flexural wear problem. The converse can also apply. For example, fibers are available for filtering at very high temperatures (nearly 2000°F) but at present there are no practicable ways of cleaning them without excessive fiber flexure. In other words, reducing the mechanical demands on a fabric may make it more tolerant of tough environmental conditions. Fabrics with different finishes, weaves, etc. may also be put on trial to circumvent a particularly troublesome mechanical or environmental problem.

H.B.

8.2.10.4 **Pulse** - As there are almost no moving parts in the pulse cleaned apparatus, hardware maintenance is certainly reduced compared to other cleaning methods. However, the excessive use of cleaning air pressure may balloon the bags so much as to weaken them by overstretching. If the fabric is being damaged and cleaning cannot be diminished, one must try another fabric or attempt to reduce the adhesiveness of the dust (Section 2.2).

8.2.10.5 Reverse Jet - As there is a fair amount of mechanism within the clean side of the baghouse, any penetration of the bags by dust results in a wearing of the mechanism, gradual or rapid, depending on dust abrasiveness. Beyond a certain point, unless the equipment is completely overhauled the mechanism will not only destroy itself but the bags as well. Thus this method of cleaning while popular in some applications is at other times associated with fairly high maintenance.

Sometimes in reverse jet equipment a hard residue of felt fiber and dust builds up on the cleaning rings so near the bags as to begin to rub. This accretion can usually be sanded off, but may be prevented by antifriction coatings or rings made of stainless steel. The cleaning rings must stay smooth and level and at the prescribed distance from the cloth. The cloth tubes must be kept taut. Equipment operability can usually be prolonged by changing from continuous to intermittent cleaning, in which the carriage pauses for a period of time between trips. Here again is the principle of using a minimum of cleaning.

8.2.11 Rotary Valves and Conveyors

These can be high maintenance items if the dust packs together or adheres to the paddle wheel or other surfaces. The intake of moisture due to faulty seals is a frequent cause of sticking. Ordinarily a good quality valve will give long service if it gets lubrication and a check of its seals and clearances from time to time. Anti-adhesion coatings may be used to some advantage on the wheel blades. A glass window in the valve (kept clean) is a popular method of telling whether the valve is discharging normally. Kraus[3] lists a number of engineering and maintenance practices for rotary valves used in pneumatic conveying.

Smeary dust material in a screw conveyor can directly cause repeated plug-ups and breakdowns. Converting to a pneumatic conveying system is not always an improvement, depending on the dust. Possibly different conditions of dust temperature or moisture will change the properties of the dust; otherwise it may be necessary to use separate collection bins instead of conveying to a central point.

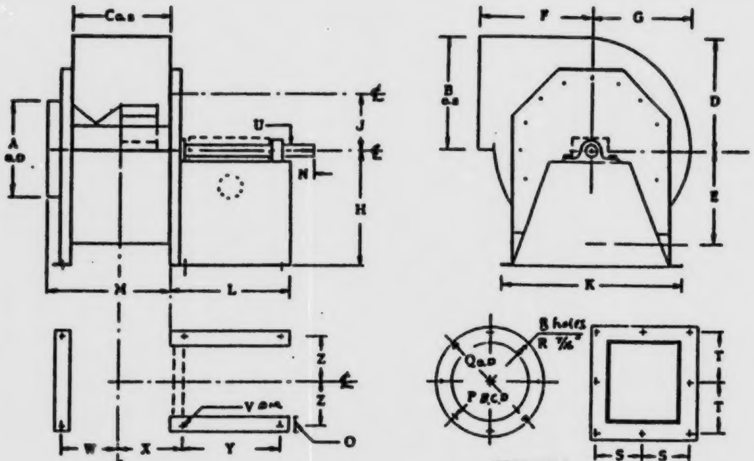
Air leaks in the rotary valve and sometimes air leaking along the conveyor from one compartment to another can re-aerosolize dust and overload the filter. Indications of this are non-zeroing manometers and unusual filter drags.

8.2.12 Instrumentation.

The operability of fail-safe mechanisms and automatic control instrumentation is very important to the safety of the filter cloth, and it is usually up to a maintenance man to be sure these are in working order. He may advise the installation of more or better instruments, since most manufacturers supply a minimum of instrumentation with their equipment in the interest of economy. Good instrumentation often pays for itself, however.

One thing to check after equipment installation is the location of all sensing instruments because a small difference in location can be serious. For example, the wrong temperature may be measured if the gases are not well mixed at the sensor location; or, a high gas velocity may give an error in the static pressure sensed at one side of a differential manometer. All instruments should be calibrated after installation, and rechecked monthly for sensor location, leaks (manometers), sticking, legibility, etc.

A central panel for most or all instrument readout,as opposed to scattered instruments,has been estimated to reduce instrument maintenance costs by as much as 50 percent, as well as making operation of the collector system more convenient. One should record instrument readings over one normal operating cycle for use in checking and troubleshooting later in the life of the equipment. The record should be posted beside each instrument.


C o.s
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8 holes R 7/16"
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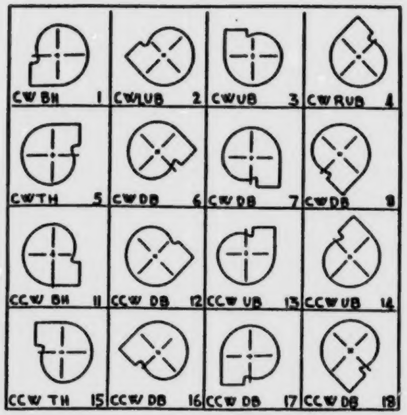
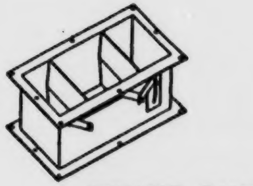
Arrangements 1&9

OPTIONAL

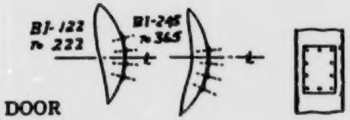

CW BH 1
CW UB 2
CW UB 3
CW RUB 4
CW TH 5
CW DB 6
CW DB 7
CW DB 8
CCW BH 11
CCW DB 12
CCW UB 13
CCW UB 14
CCW TH 15
CCW DB 16
CCW DB 17
CCW DB 18



EXHAUST DAMPER

OPTIONAL

DRAIN


BI-122 to 222
BI-245 to 365

ACCESS DOOR

Dimensions ± 1/16

*Dimensions varies with class

BI	A	B	C	D	E	F	G	H*	J	K	L	M	N	O	P	Q	S	T	U	V	W	X	Y	Z
122	14	13½	10½	13¾	10½	11	11¾	17¾	6 15/16	19½	18	12⅜	3	1½	15⅜	16½	5¾	7⅜	1 5/16	½	6¼	7¼	14	9⅛
135	16	15	11½	14⅞	11½	12	13	18⅞	7 5/16	21½	18	13¾	3	1½	17⅜	18½	6¾	8½	1 3/16	½	7	7¾	14	10¾
150	18	16⅝	12¾	16½	12⅝	13	14⅝	20½	8¼	23½	18	14⅝	3	1½	17½	21	7	8 11/16	1 5/16	½	7¾	8¾	14	11½
165	19	18⅛	13⅞	18	13⅞	14	16	22	9	25½	20	15¾	3	1½	20⅝	22	7 9/16	9 9/16	1 5/16	½	8 7/16	9 13/16	16	12½
182	21	20½	15½	20	15½	15	17⅝	24	10	27½	20	17⅜	3½	2	22⅝	24	8⅝	11	1 7/16	½	9⅜	9¾	16	13¼
200	24	22	16⅞	21⅞	17⅜	16⅝	19⅛	25¾	10 13/16	30½	22	18¾	4	2	25 7/16	27	9 5/16	11⅞	1 7/16	½	9 13/16	10 3/16	18	14⅝
222	27	24⅜	18⅞	24½	18¾	18	21⅜	28½	12⅛	33½	22	20⅝	4	2	28 7/16	30	10 9/16	13 5/16	1 7/16	½	10⅞	11¾	18	16½
245	30	26⅞	20¾	26¾	20¾	20	23⅝	30¾	13¾	36½	24	22⅝	4	2	31⅛	33	10¾	14 13/16	1 9/16	½	11⅝	12⅜	20	17⅜
270	33	29⅝	22⅛	29½	23	22½	26½	33½	14 5/16	39½	28	24¾	4	2	34 7/16	36	12 13/16	16 3/16	1 9/16	½	12⅞	13 5/16	24	19½
→ 300	37	32¾	25½	32¾	25¾	25	29	36¾	16 5/16	43½	30	27½	4	2	39 7/16	40	14	17¾	1 11/16	½	14⅛	15¾	25	21½
330	40	36½	27¾	36	27½	27	31½	40	18	46½	30	29¾	4	2	41⅞	43	15¾	19 5/16	1 13/16	½	15⅜	16⅞	25	22⅝
365	43	40	30¾	39¾	30¾	29	35¼	43¾	19 11/16	49½	30	32¾	4	2	44¾	46	11¾	16¾	2 5/16	½	16⅞	18¾	25	24½

INDUSTRIAL EXHAUSTER

CUSTOMER SPECIFICATIONS	15000 ACFM @ 9. S.P. - 50HP MOTOR SUPPLIED. INLET FLANGE. - Hi Temp Const. - heat Slinger SPLIT Pillow Block Bearing - SHAFT - 2 7/16 HD. DRIVES. c/w BELT GUARD. - MOUNTED ON 6" CHANNEL FRAME. Fig 15.

Certified Dimensions

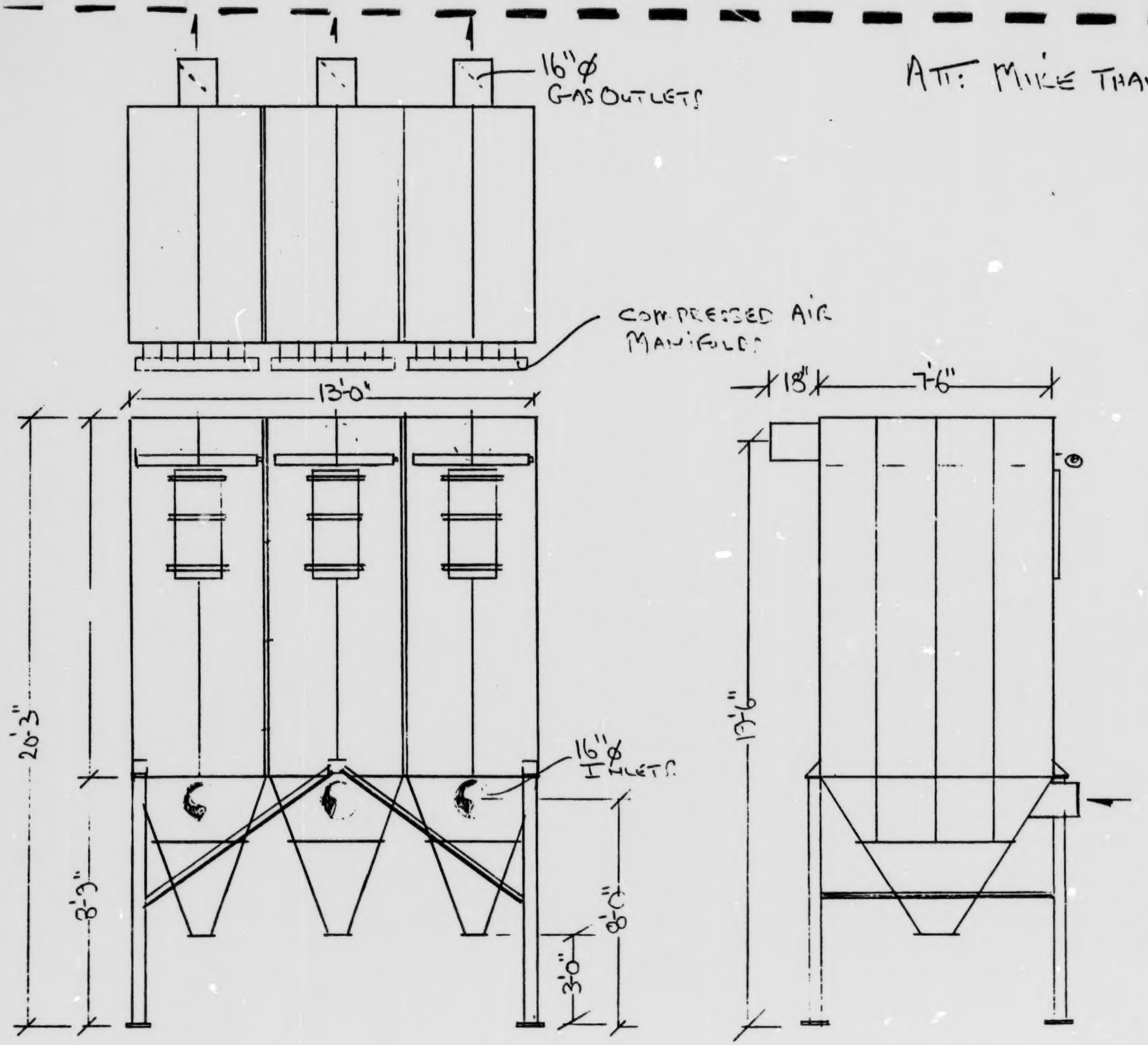
By

Date

BI-300 - CCW - TH. Arr 1-9-BASE MT.		
SCALE: NIL DATE: 8-15-85	APPROVED BY:	DRAWN BY CT REVISED
DALTEC INDUSTRIES LTD.		
AIR CORRECTION - RB.		DRAWING NUMBER 85-1989.

11 X 17 PRINTED ON NO. 1000H CLEARPRINT ®

ATT: MIKE THANISCH


16" ϕ
GAS OUTLETS
COMPRESSED AIR
MANIFOLDS
13'-0"
16" ϕ
INLETS
20'-3"
8'-3"
8'-0"
3'-0"
18"
7'-6"
13'-6"

CARE AND CLEANING OF FILTER BAGS

GENERAL

Natural filter fabrics (wool or cotton) are subject to shrinkage when wet with water. These fabrics must be dry cleaned.

Synthetic filter fabrics (Orlon, Dacron, Nomex, Polypropylene, and Teflon) can be either laundered or dry cleaned.

LAUNDERING:

Thoroughly vacuum clean the filter bags to remove the bulk of the dust. Wash the bags at a water temperature of about 130°F., not to exceed 140°F., with a mild soap such as a typical dishwashing detergent. It is recommended that the filter bags be drip dried by hanging them in a warm room. If the filter bags are tumble dried, low drying temperature settings must be used.

DRY CLEANING:

Thoroughly vacuum clean the filter bags to remove the bulk of the dust. Put the filter bags through a standard dry cleaning procedure. Use pure dry-cleaner's solvent. Dry cleaning detergents and additives that require addition of water to the solvent should not be used in order to eliminate any possibility of fabric shrinkage. Drip drying is again the recommended drying method. Tumble drying should be done at low drying temperatures.

The degree of solubility of the dust in water or solvent will normally dictate which cleaning method is to be used, except of course when the filter fabric is cotton or wool which must only be dry cleaned.

INSPECTION and REPAIR:

After bags have been cleaned they are to be thoroughly inspected visually. Special consideration should be given to worn or weak spots which can be verified by observation against a strong (approximately 150W) light. All cuts, tears and worn spots must be repaired. If repairs appear excessive discard bag or cut up to make patches.

Repairs may be made by applying patches of equal material over holes, tears or weak areas and either hand or machine sewn into place. Fabric glues may be used with the understanding that some filter area might be lost (area of patch). In sewing small close stiches must be used to prevent leakage. Also, it is recommended that patches be at least 4" larger than hole or tear. Use heavy duty thread of comparable material to the bag.

INSTALLATION AND MAINTENANCE INSTRUCTIONS

REMOTE PILOT OPERATED 2-WAY VALVES

BULLETIN

8353

Kit No. 96-875

Form No. V-5162 R5

DESCRIPTION

Bulletin 8353 is a 2-way diaphragm type air valve designed for remote pilot operation. Valves have an angle type aluminum body with a 1/8 N.P.T. connection in the valve bonnet for connection to the ASCO remote pilot valve. Valves are designed for multi-unit installations with separately mounted ASCO pilot valves.

OPERATION

When remote pilot valve opens, pressure above the diaphragm is released allowing main line pressure to act against the underside of the diaphragm, opening the main valve orifice. When pilot valve closes, main line pressure bleeds to the top of the diaphragm and closes the main orifice.

INSTALLATION

Check valve bonnet for correct catalog number, pressure and service.

POSITIONING

Valve may be mounted in any position.

PIPING/TUBING

Connect piping to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only; if applied to valve threads, it may enter the valve and cause operational difficulty. Pipe strain should be avoided by proper support and alignment of piping. When tightening pipe, do not use valve as a lever. Wrenches applied to valve body or piping are to be located as close as possible to connection point. The remote ASCO pilot valve should be mounted as close as possible to the main valve. For correct ASCO pilot valve, consult factory. For proper operation of valve, a specific pilot valve must be utilized. Connecting tubing lengths of ten feet or less have little effect on the pulse response. Installations with over ten feet of tubing must be tested under actual operating conditions. Tubing with 1/4 O.D. is recommended for all installations.

CAUTION: To avoid damage to the valve body, DO NOT OVER-TIGHTEN PIPE CONNECTIONS. If teflon tape, paste, spray or similar lubricant is used, use extra care due to reduced friction.

IMPORTANT: For the protection of the valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Periodic cleaning is required, depending on the service conditions. See Bulletins 8600, 8601 and 8602 for strainers.

MAINTENANCE

WARNING: Depressurize valve and bleed air from header before making repairs. It is necessary only to remove the tubing from the remote pilot valve.

CLEANING

A periodic cleaning of all valves is desirable. The time between cleaning will vary, depending upon media and service conditions. In general, sluggish valve operation or excessive leakage or noise will indicate that cleaning is required.

PREVENTIVE MAINTENANCE

1. Keep the medium flowing through the valve as free from dirt and foreign material as possible.
2. While in service, operate valve at least once a month to insure proper opening and closing.
3. Periodic inspection (depending on media and service conditions) of internal valve parts for damage or excessive wear is recommended. Thoroughly clean all parts. Replace any parts that are worn or damaged.

IMPROPER OPERATION

1. **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within 5-125 psi.
2. **Excessive Leakage:** Disassemble valve and clean all parts. Replace parts that are worn or damaged with a complete Spare Parts Kit for best results.
3. **Failure to Open or Close:**
   A. If diaphragm valve stays open, bleed hole may be clogged. If diaphragm valve stays closed, diaphragm may be torn. Disassemble valve and clean or replace diaphragm assembly.
   B. Failure of the remote pilot solenoid valve can also cause the diaphragm valve to stay closed or open. Inspect remote pilot solenoid valve for proper opening and closing.

VALVE DISASSEMBLY AND REASSEMBLY (Refer to Figures 1 & 2)

Depressurize valve and bleed air from headers before making repairs. Remove tubing connection from remote pilot valve. Proceed in the following manner:

1. Remove bonnet screws, valve bonnet, diaphragm spring and diaphragm assembly. If the valve you are disassembling contains a square cut gasket or a step spacer as shown in the sectioned view, Figure 2, the square cut gasket or step spacer need not be replaced unless damaged. If a replacement is required, order by the numbers indicated in Figure 2.
2. Diaphragm assembly is now accessible for cleaning or replacement. Replace diaphragm assembly if worn or damaged.
3. Reassemble in reverse order of disassembly paying careful attention to exploded view provided for identification and placement of parts.
4. Replace diaphragm assembly, (for ease of assembly, the tab may be located in any position) diaphragm spring, valve bonnet and bonnet screws. Torque bonnet screws in a crisscross manner to 10 - 11 foot-pounds.
5. Replace tubing connection from remote pilot valve.
6. After maintenance, operate the valve a few times to be sure of proper opening and closing.

SPARE PARTS KITS

Spare Parts Kits are available for ASCO valves.
Parts marked with an asterisk (*) are supplied in Spare Parts Kit.

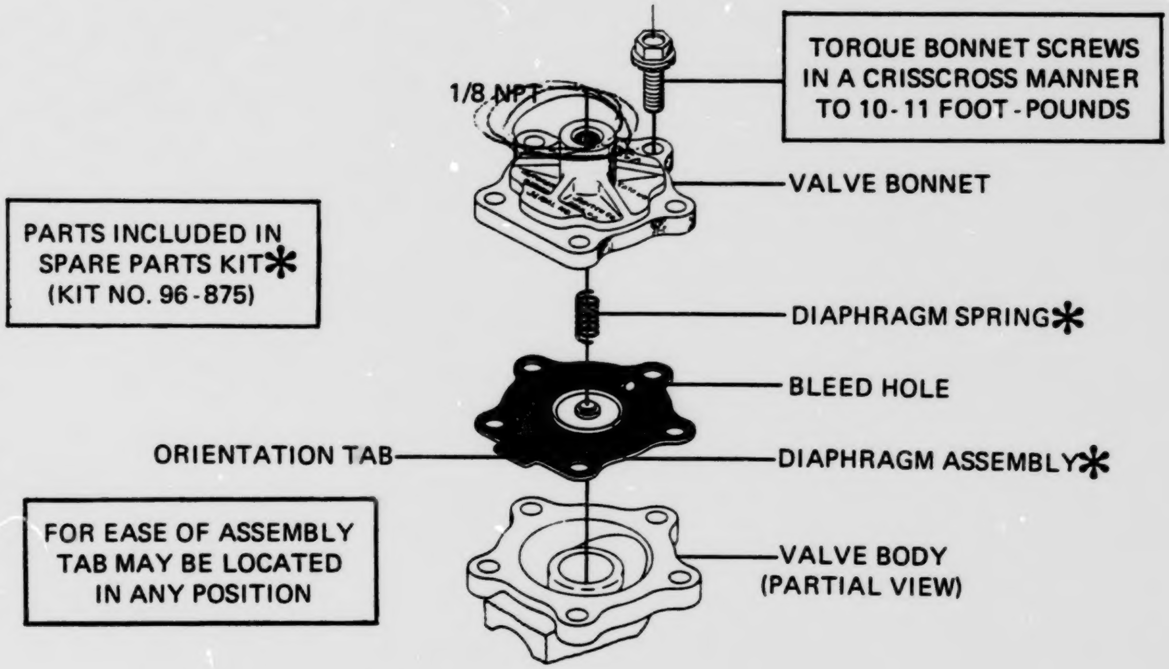
ORDERING INFORMATION FOR SPARE PARTS KITS

When Ordering Spare Parts Kits,
Specify Valve Catalog Number and Serial Number.
Order Kit No. 96-875

For Square Cut Gasket, Order
Part No. 88-224-228A

For Step Spacer, Order
Part No. 93-834-1

ASCO Valves
ASCOLECTRIC LIMITED BRANTFORD, ONTARIO


1/8 NPT
VALVE BONNET
DIAPHRAGM SPRING*
BLEED HOLE
ORIENTATION TAB
DIAPHRAGM ASSEMBLY*
VALVE BODY
(PARTIAL VIEW)

TORQUE BONNET SCREWS IN A CRISSCROSS MANNER TO 10-11 FOOT-POUNDS

PARTS INCLUDED IN SPARE PARTS KIT*
(KIT NO. 96-875)

FOR EASE OF ASSEMBLY TAB MAY BE LOCATED IN ANY POSITION

Figure 1. Bulletin 8353

IMPORTANT

THE SQUARE CUT GASKET AND STEP SPACER SHOWN BELOW ARE USED IN OLD STYLE VALVES ONLY. THEY ARE NOT SUPPLIED IN SPARE PARTS KITS, BUT IF REQUIRED, THEY MAY BE ORDERED INDIVIDUALLY BY PART NUMBER.

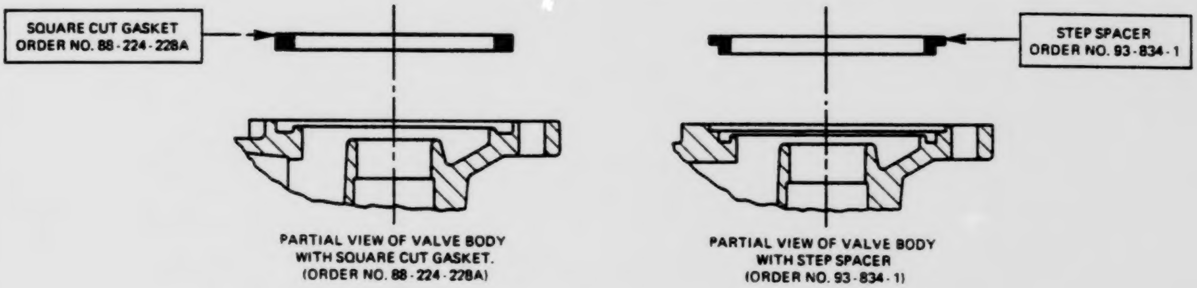
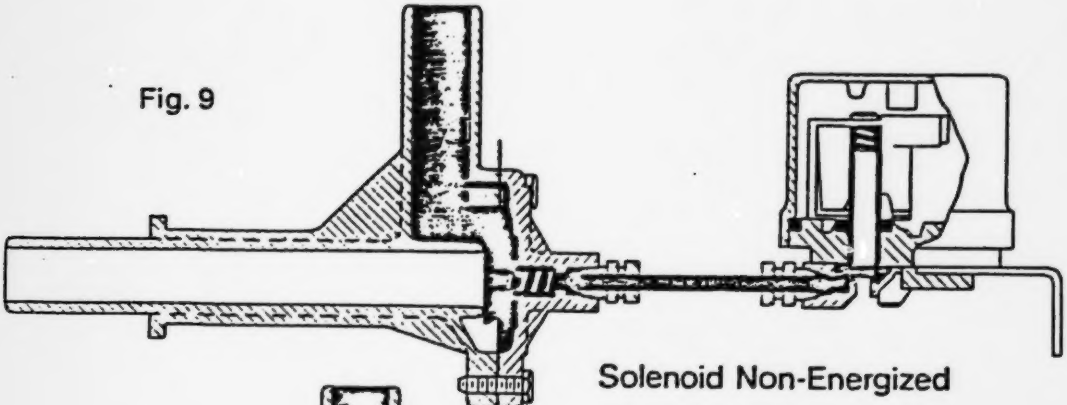

SQUARE CUT GASKET
ORDER NO. 88-224-228A
STEP SPACER
ORDER NO. 93-834-1
PARTIAL VIEW OF VALVE BODY
WITH SQUARE CUT GASKET.
(ORDER NO. 88-224-228A)
PARTIAL VIEW OF VALVE BODY
WITH STEP SPACER
(ORDER NO. 93-834-1)

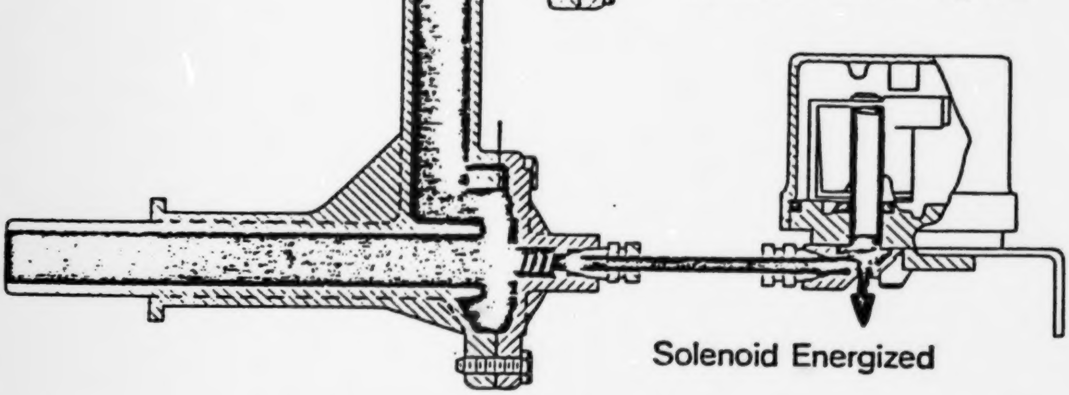
Figure 2. Bulletin 8353
Partial Views Showing Square Cut Gasket and Step Spacer used in Older Style Valves.

ASCO **ASCO Valves**
ASCOLECTRIC LIMITED BRANTFORD, ONTARIO
Form No. V-5162R5 PRINTED IN CANADA 1977

Fig. 9

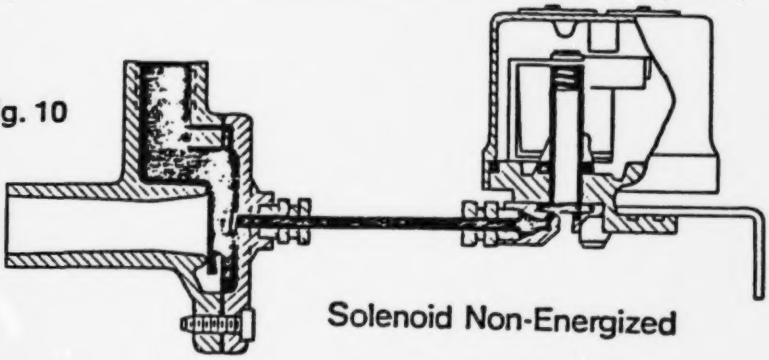


Solenoid Non-Energized

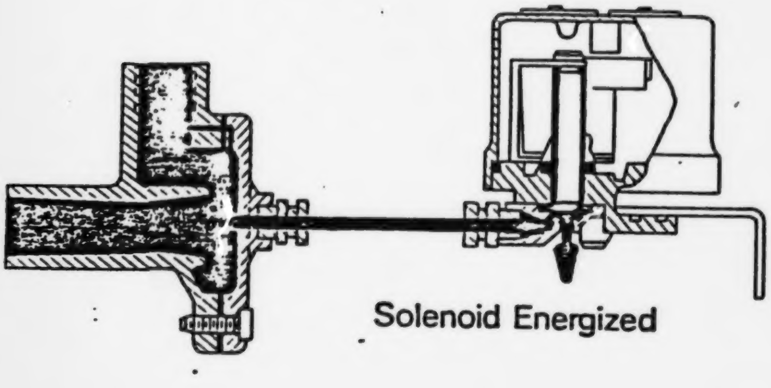


Solenoid Energized

Fig. 10



Solenoid Non-Energized



Solenoid Energized

SOLENOID VALVE COIL DATA

COILS

ASCO

Form No. V-5192AR4

COIL CLASSIFICATION

COIL TYPE	GRADE OF INSULATION	AMBIENT TEMP. (NOTE 1)	APPLICATION CONDITIONS (NOTE 2)
Class A	A	77° F	For normal pressure or ambient temperatures (For molded coils see Note 3)
Class F (FT) High Temp.	F	167° F	For high ambient or fluid temperatures (Notes 3 & 5)
Class F (FB) Intermediate Power	F	122° F	For higher valve pressure ratings, high ambient or fluid temperatures (Note 3)
Class F (FF) High Power	F	77° F	For higher valve pressure ratings at normal ambient temperatures (Note 3)
Class H (HT) High Temp.	H	212° F	For Higher ambient or fluid temperatures than Class F (Notes 4 & 5)
Class H (HB) Intermediate Power	H	167° F	For higher valve pressure ratings, plus higher ambient or fluid temperatures than Class F (Note 4)
Class H (HP) High Power	H	77° F	For higher valve pressure ratings than Class F, at normal ambient temperatures (Note 4)

NOTES:
1. This is the maximum ambient temperature for continuous duty. Coils rated for ambient temperatures of 77° F may be employed in areas where ambient temperatures reach 104° F occasionally.
2. The maximum fluid temperature will vary between solenoids and valve types, refer to catalog listings for maximum temperature limitations.
3. Molded coils are moisture proof and fungus proof.
4. Coils are fungus proof and radiation resistant.
5. Suitable for 24, 120, 240, 480 volts, A-C 60 HZ (or 50 HZ in 110 volt multiples)

Fig. 1

CONTINUOUS DUTY RATING

VOLTAGE RATING A-C	NORMAL OPERATING RANGE	VOLTAGE RATING D-C	NORMAL OPERATING RANGE
24	22-24	6	5.1 - 6.3
120	110-120	12	10.2 - 12.6
240	220-240	24	20 - 25
480	440-480	120	102 - 126

All ASCO valves are tested to operate at 15% under the nominal voltage and are capable of operating for short periods at 10% over the nominal voltage. For wider voltage ranges than shown above, a different coil must be used.

Fig. 3

INSTRUCTIONS FOR REPLACING COIL

Turn off electric power supply and line pressure to the valve. Disconnect the coil lead wires. Remove the solenoid cover. Disassemble and reassemble in order shown in Fig. 2.

NOTE: The solenoid must be fully reassembled as the housing is part of and completes the magnetic circuit.

NOTE: To change from Alternating Current (A-C) to direct Current (D-C) or reverse, it is necessary to change the complete solenoid.

Fig. 4

ACCESSORIES

Please send information on the following:

☐ STRAINERS

☐ SPEED CONTROL VALVES

Maintenance Instructions for ASCO valves will be gladly furnished. To request copies, specify the valve catalog number.

STRAINERS

Remove dirt and pipe scale from the line to reduce friction and provide longer life for equipment.

SPEED CONTROL VALVES

For controlling cylinder piston speeds. Used with ASCO 3 and 4 way solenoid valves.

EXPLODED VIEWS

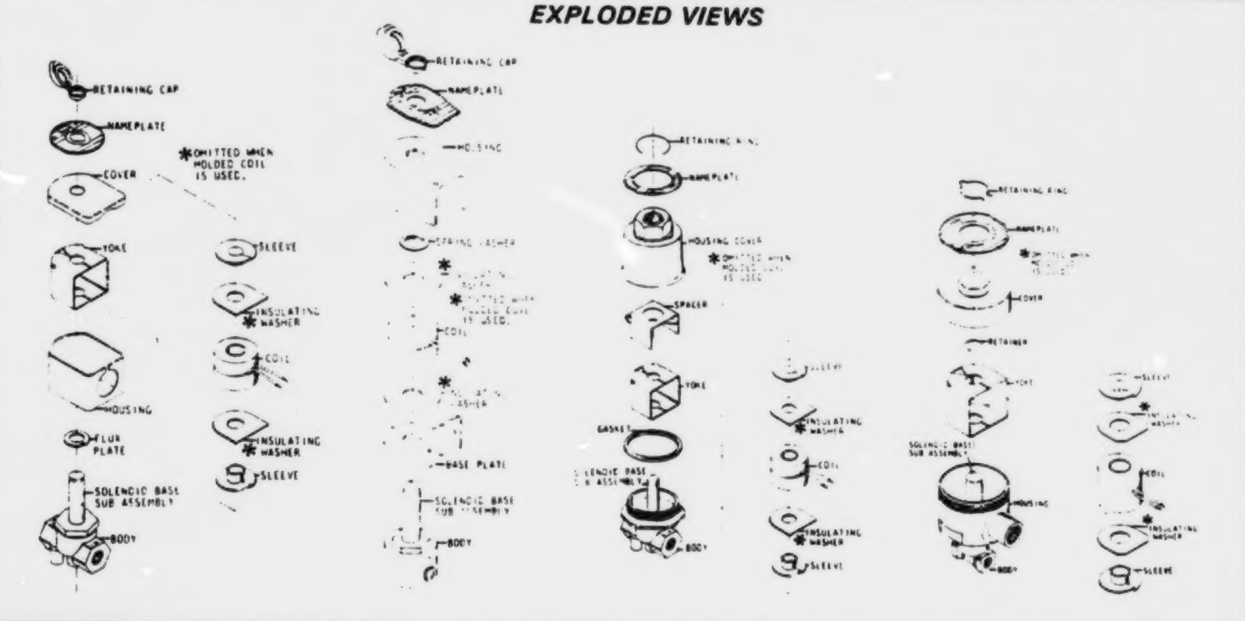


Fig. 2

ASCO **ASCO Valves**
ASCOLECTRIC limited BRANTFORD, ONTARIO FORM NO. V-5192AR4 PRINTED IN CANADA 1974

INSTALLATION AND MAINTENANCE INSTRUCTIONS

2-WAY DIRECT ACTING SOLENOID VALVES NORMALLY OPEN AND NORMALLY CLOSED

BULLETINS
8262
8263
FORM NO. V-5256R5

ASCO

DESCRIPTION

Bulletins 8262 and 8263 are 2-way direct acting solenoid valves having bodies of brass or stainless steel. Standard valves have a General Purpose Nema Type I Solenoid Enclosure. Valves that are equipped with a solenoid enclosure, which is designed to meet Nema Type 4–Watertight, Nema Type 7 (C or D) Hazardous Locations – Class I–Group C or D, and Nema Type 9 (E, F or G) Hazardous Locations – Class II Group E, F or G, are shown on separate sheets of Installation and Maintenance Instructions, Form Nos. V-5391, V-5381 and V-5380.

OPERATION

Normally Closed: Open when energized, closed when de-energized.
Normally Open: Closed when energized, open when de-energized.

MANUAL OPERATOR (Optional Ref. Fig. 3)

Valves with suffix "MS" in catalog number, are provided with a screw type manual operator which allows manual operation when desired or during an interruption of electrical power.

FLOW METERING DEVICES (Optional Ref. Fig. 3)

Valves with suffix "M" in catalog number are provided with a metering device for flow control.

INSTALLATION

Check nameplate for correct catalog number, pressure, voltage and service.

POSITIONING

Valve may be mounted in any position.

PIPING

Connect piping to valve according to markings on valve body. Apply pipe compound sparingly to male pipe threads only; if applied to valve threads, it may enter valve and cause operational difficulty. Pipe strain should be avoided by proper support and alignment of piping. When tightening pipe, do not use valve as a lever.

IMPORTANT: For protection of the solenoid valve, install a strainer or filter suitable for the service involved in the inlet side as close to the valve as possible. Periodic cleaning is required, depending on the service conditions. See Bulletins 8600, 8601 and 8602 for strainers.

WIRING

Wiring must comply with Local and National Electrical Codes. For valves equipped with an explosion-proof, watertight solenoid enclosure, the electrical fittings must be approved for use in the approved hazardous locations. Housings for all solenoids are made with connections for ½ inch conduit. The general purpose enclosure may be rotated to facilitate wiring by removing the retaining cap.

NOTE: Alternating Current (A-C) and Direct Current (D-C) solenoids are built differently. To convert from one to the other, it is necessary to change the complete solenoid including the solenoid base sub-assembly and core assembly.

SOLENOID TEMPERATURE

Standard catalog valves are supplied with coils designed for continuous duty service. When the solenoid is energized for a long period, the solenoid enclosure becomes hot and can be touched with the bare hand for only an instant. This is a safe operating temperature. Any excessive heating will be indicated by the smoke and odor of burning coil insulation.

MAINTENANCE

WARNING: Turn off electrical power and line pressure to valve before making repairs. It is not necessary to remove valve from pipe line for repairs.

CLEANING

A periodic cleaning of all solenoid valves is desirable. The time between cleanings will vary, depending on the media and service conditions. In general, if the voltage to the coil is correct, sluggish valve operation or excessive leakage will indicate that cleaning is required.

IMPROPER OPERATION

1. **Faulty Control Circuit:** Check the electrical system by energizing the solenoid. A metallic click signifies solenoid is operating. Absence of the click indicates loss of power supply. Check for loose or blown-out fuses, open-circuited or ground coil, broken lead wires or splice.
2. **Burned-Out Coil:** Check for open-circuited coil. Replace coil if necessary.
3. **Low Voltage:** Check voltage across the coil leads. Voltage must be at least 85% of nameplate rating.
4. **Incorrect Pressure:** Check valve pressure. Pressure to valve must be within range specified on nameplate.
5. **Excessive Leakage:** Disassemble valve and clean all parts. Replace parts that are worn or damaged with a complete Spare Parts Kit for best results.

COIL REPLACEMENT (Ref. Fig. 1)

Turn off electrical power supply and disconnect coil lead wires. Refer to exploded view (Figure 1). Choose Construction 1A or 1B and refer to replacement instructions 1A or 1B.

Coil Replacement, Construction Figure '1A'

1. Remove retaining cap, nameplate and housing.
2. Slip spring washer, insulating washers and coil off solenoid base sub-assembly. Insulating washers are omitted when a molded coil is used.
3. Reassemble in reverse order of disassembly.

Coil Replacement, Construction Figure '1B'

1. Remove retaining cap, nameplate and cover.
2. Slip yoke containing coil, sleeves and insulating washers off the solenoid base sub-assembly or plugnut/core tube sub-assembly. Insulating washers are omitted when a molded coil is used. In some D-C Construction, a single flux plate over the coil replaces yoke, sleeves and insulating washers.
3. Reassemble in reverse order of disassembly.

CAUTION: Solenoid must be fully reassembled as the housing is part of, and completes the magnetic circuit.

VALVE DISASSEMBLY AND REASSEMBLY

(Refer to Exploded Views)

Depressurize valve and turn of electrical power supply.

1. Remove retaining cap and slip entire solenoid enclosure off the solenoid base sub-assembly or plugnut/core tube sub-assembly.
2. Unscrew bonnet or solenoid base sub-assembly and remove core spring, core assembly and body gasket.
3. All parts are now accessible for cleaning or replacement. Replace worn or damaged parts with a complete Spare Parts Kit for best results.
4. Reassemble in reverse order of disassembly paying careful attention to Exploded Views provided.

SPARE PARTS KITS

Spare Parts Kits and Coils are available for ASCO valves. Parts marked with an asterisk (*) are included in Spare Parts Kits.

ORDERING INFORMATION FOR SPARE PARTS KITS

When Ordering Spare Parts Kits or Coils Specify Valve Catalog Number, Serial Number and Voltage.

FORM NO. V-5256R5 – PRINTED IN CANADA – 1969

ASCO Valves ASCO
ASCOLECTRIC LIMITED BRANTFORD, ONTARIO

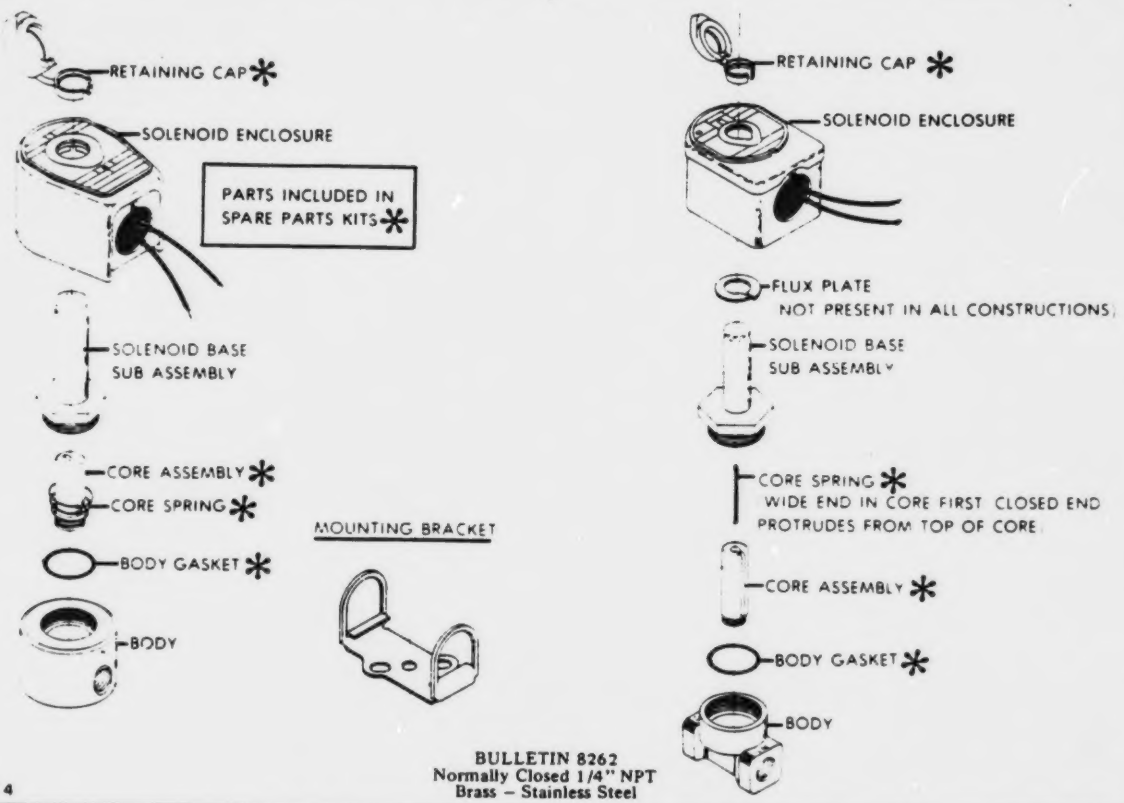

RETAINING CAP *
SOLENOID ENCLOSURE
PARTS INCLUDED IN SPARE PARTS KITS *
SOLENOID BASE SUB ASSEMBLY
CORE ASSEMBLY *
CORE SPRING *
BODY GASKET *
BODY
MOUNTING BRACKET
RETAINING CAP *
SOLENOID ENCLOSURE
FLUX PLATE (NOT PRESENT IN ALL CONSTRUCTIONS)
SOLENOID BASE SUB ASSEMBLY
CORE SPRING * WIDE END IN CORE FIRST. CLOSED END PROTRUDES FROM TOP OF CORE.
CORE ASSEMBLY *
BODY GASKET *
BODY

FIGURE 4

BULLETIN 8262
Normally Closed 1/4" NPT
Brass – Stainless Steel

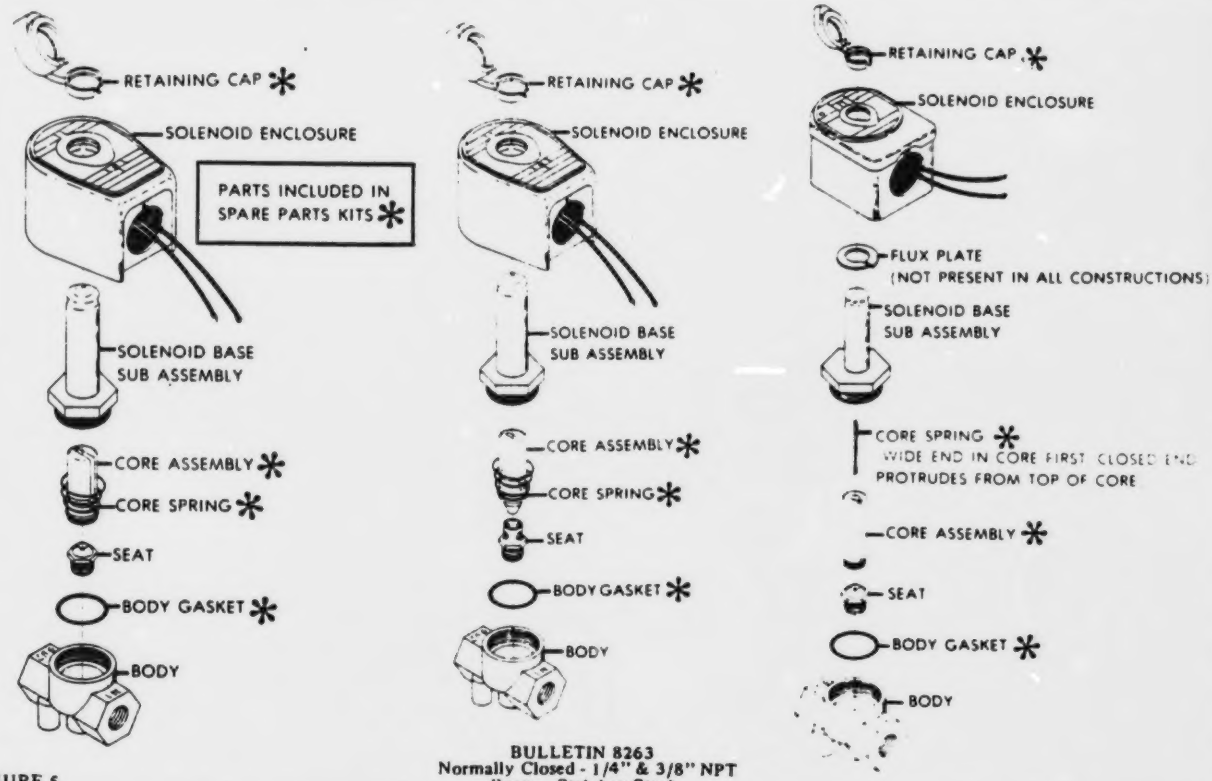

RETAINING CAP *
SOLENOID ENCLOSURE
PARTS INCLUDED IN SPARE PARTS KITS *
SOLENOID BASE SUB ASSEMBLY
CORE ASSEMBLY *
CORE SPRING *
SEAT
BODY GASKET *
BODY
RETAINING CAP *
SOLENOID ENCLOSURE
SOLENOID BASE SUB ASSEMBLY
CORE ASSEMBLY *
CORE SPRING *
SEAT
BODY GASKET *
BODY
RETAINING CAP *
SOLENOID ENCLOSURE
FLUX PLATE (NOT PRESENT IN ALL CONSTRUCTIONS)
SOLENOID BASE SUB ASSEMBLY
CORE SPRING * WIDE END IN CORE FIRST. CLOSED END PROTRUDES FROM TOP OF CORE
CORE ASSEMBLY *
SEAT
BODY GASKET *
BODY

FIGURE 5

BULLETIN 8263
Normally Closed - 1/4" & 3/8" NPT
Brass – Stainless Steel

FORM NO. V-5256R5 – PRINTED IN CANADA – 1969

ASCO Valves ASCO
ASCOLECTRIC LIMITED BRANTFORD, ONTARIO

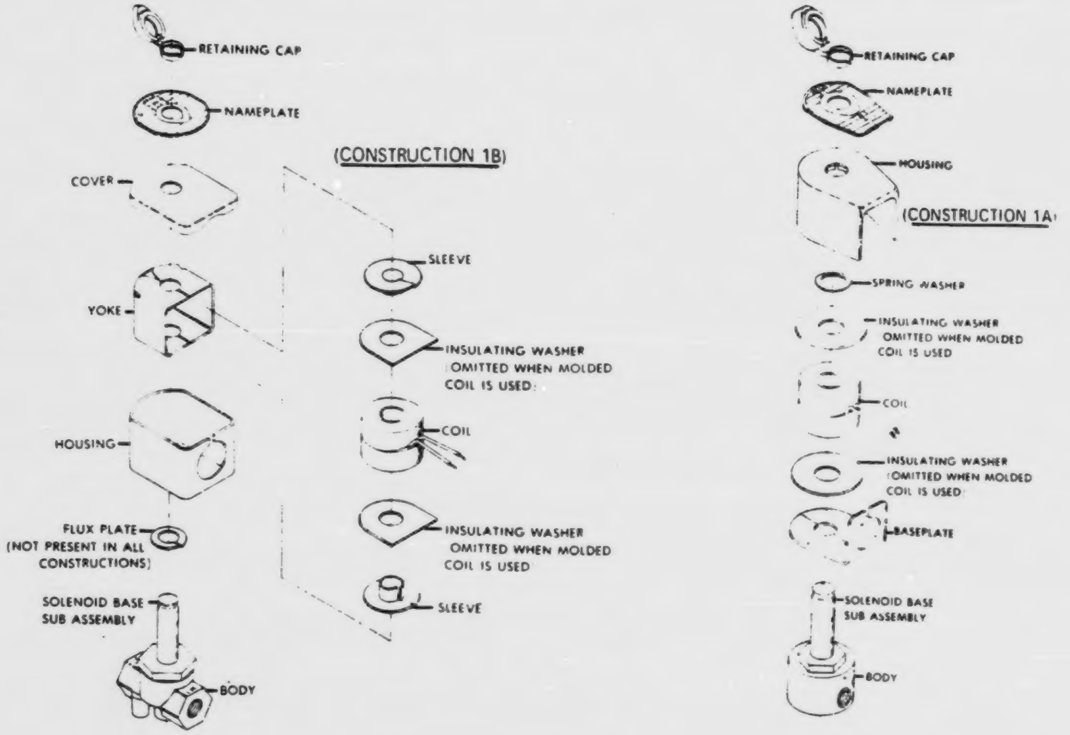

RETAINING CAP
NAMEPLATE
COVER
YOKE
HOUSING
FLUX PLATE
(NOT PRESENT IN ALL CONSTRUCTIONS)
SOLENOID BASE SUB ASSEMBLY
BODY
(CONSTRUCTION 1B)
SLEEVE
INSULATING WASHER (OMITTED WHEN MOLDED COIL IS USED)
COIL
INSULATING WASHER (OMITTED WHEN MOLDED COIL IS USED)
SLEEVE
RETAINING CAP
NAMEPLATE
HOUSING
(CONSTRUCTION 1A)
SPRING WASHER
INSULATING WASHER OMITTED WHEN MOLDED COIL IS USED
COIL
INSULATING WASHER (OMITTED WHEN MOLDED COIL IS USED)
BASEPLATE
SOLENOID BASE SUB ASSEMBLY
BODY

FIGURE 1 COIL REPLACEMENT

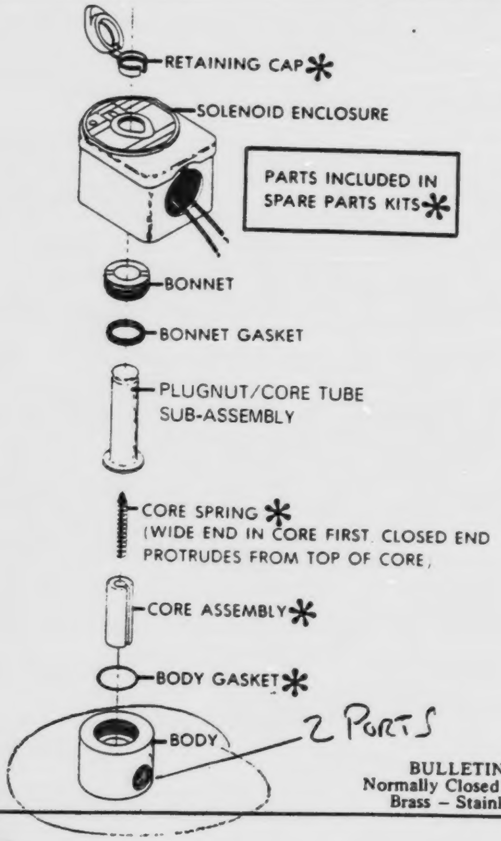
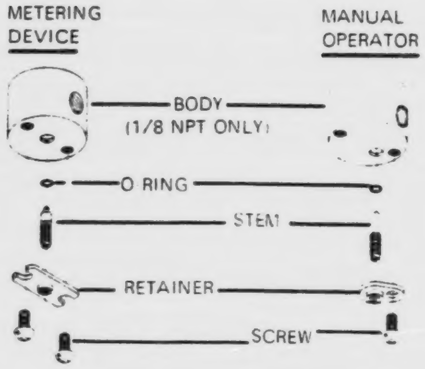

RETAINING CAP *
SOLENOID ENCLOSURE
PARTS INCLUDED IN SPARE PARTS KITS *
BONNET
BONNET GASKET
PLUGNUT/CORE TUBE SUB-ASSEMBLY
CORE SPRING * (WIDE END IN CORE FIRST. CLOSED END PROTRUDES FROM TOP OF CORE.)
CORE ASSEMBLY *
BODY GASKET *
BODY
2 PORTS

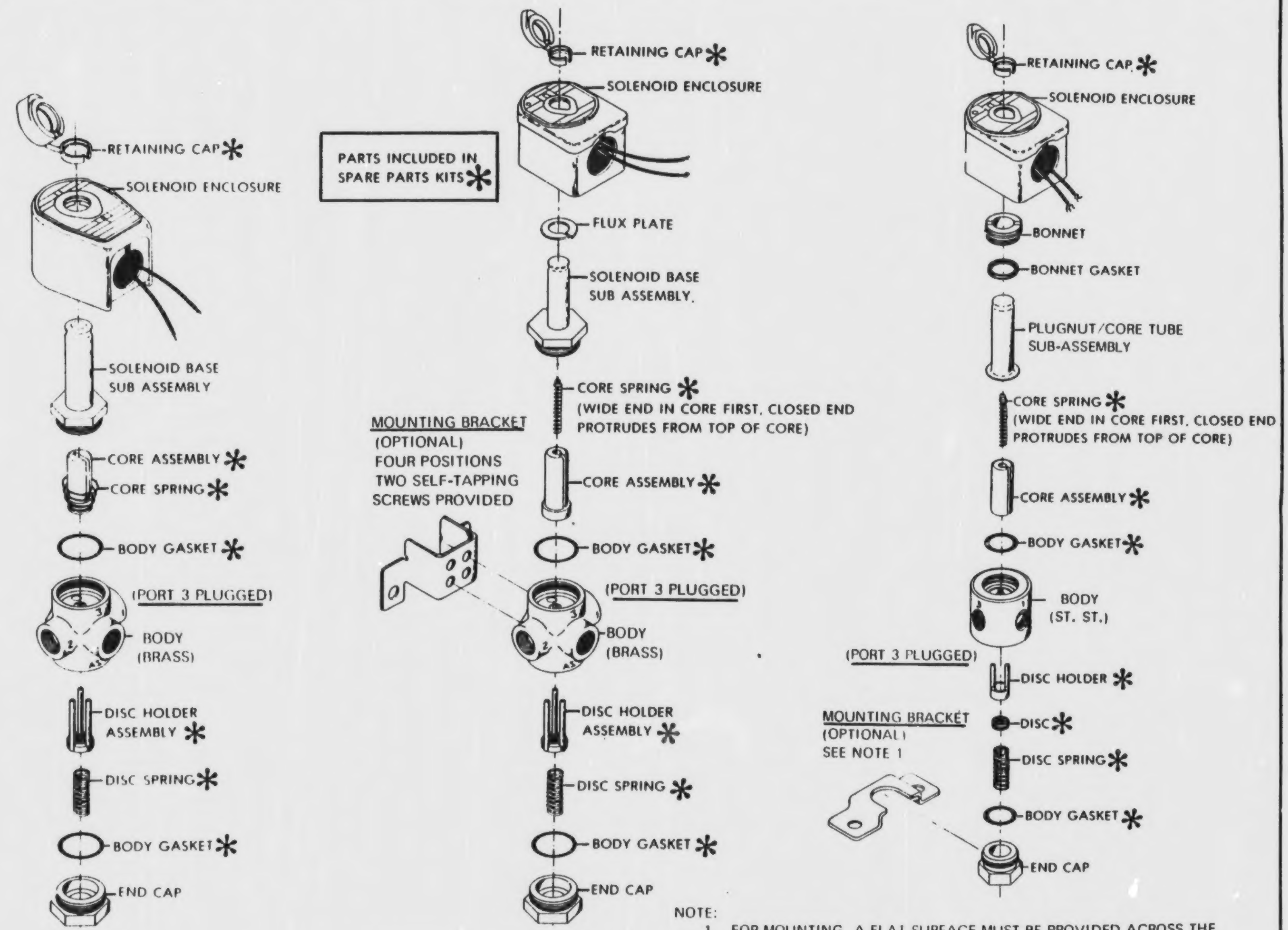
FIGURE 2

BULLETIN 8262
Normally Closed - 1/8" NPT
Brass – Stainless Steel


METERING DEVICE
MANUAL OPERATOR
BODY (1/8 NPT ONLY)
O RING
STEM
RETAINER
SCREW

FLOW METERING AND MANUAL OPERATOR CONSTRUCTIONS

FIGURE 3


RETAINING CAP *
SOLENOID ENCLOSURE
SOLENOID BASE SUB ASSEMBLY
CORE ASSEMBLY *
CORE SPRING *
BODY GASKET *
(PORT 3 PLUGGED)
BODY (BRASS)
DISC HOLDER ASSEMBLY *
DISC SPRING *
BODY GASKET *
END CAP
PARTS INCLUDED IN SPARE PARTS KITS *
RETAINING CAP *
SOLENOID ENCLOSURE
FLUX PLATE
SOLENOID BASE SUB ASSEMBLY.
CORE SPRING *
(WIDE END IN CORE FIRST, CLOSED END PROTRUDES FROM TOP OF CORE)
MOUNTING BRACKET
(OPTIONAL)
FOUR POSITIONS
TWO SELF-TAPPING
SCREWS PROVIDED
CORE ASSEMBLY *
BODY GASKET *
(PORT 3 PLUGGED)
BODY (BRASS)
DISC HOLDER ASSEMBLY *
DISC SPRING *
BODY GASKET *
END CAP
RETAINING CAP *
SOLENOID ENCLOSURE
BONNET
BONNET GASKET
PLUGNUT/CORE TUBE SUB-ASSEMBLY
CORE SPRING *
(WIDE END IN CORE FIRST, CLOSED END PROTRUDES FROM TOP OF CORE)
CORE ASSEMBLY *
BODY GASKET *
BODY (ST. ST.)
(PORT 3 PLUGGED)
DISC HOLDER *
DISC *
DISC SPRING *
BODY GASKET *
END CAP
MOUNTING BRACKET
(OPTIONAL)
SEE NOTE 1

NOTE:

1. FOR MOUNTING, A FLAT SURFACE MUST BE PROVIDED ACROSS THE ENTIRE LENGTH OF THE BRACKET. THE VALVE BODY BECOMES SECURE TO BRACKET, WHEN BRACKET IS TIGHTENED IN TO POSITION.

BULLETIN 8263
Normally Open - 1/8" & 1/4" NPT
Brass – Stainless Steel

FIGURE 6

AIR CORRECTION CANADA
DIVISION OF
SPACE-OFF
PRODUCTS LIMITED
282 Belfield Road, Rexdale, Ontario M9W 1H5
Tel: 675-1549 Telex: 06-989229

PACKING SLIP.

[redacted]

Date: November 27, 1985

Terms:

Ship to:

Same

Sold to:

New Brunswick Electric Power Comm.
Chatham Generation Station
Chatham, New Brunswick

Attn: Joe Young, Stores Dept.
Re: Pilot Dust Collector

Customer Order No.	Date P.O. Received	Contract No.	Reference	Salesman
060-8075			CWF4/NRC	

Date Shipped	Shipped Via	Partial	Complete	Way Bill No.	Weight	No. of Pieces
November 27/85	Purolator		X		50 lb.	3 ctns.

Item No.	Quantity	Description	Unit Price	Qty. Shipped	Amount
1	3	Solid State Timer, c/w Solenoid Valves		3	
2	3	Magnehelic Gauges		3	
3	212	Tridom Gear Clamps		212	
4	100 ft.	Copper Tubing		100'	
5	50	Compression Fittings		50	

AIR CORRECTION CANADA
DIVISION OF
SPACE-OFF
PRODUCTS LIMITED
282 Belfield Road, Rexdale, Ontario M9W 1H5
Tel: 675-1549 Telex: 06-989229

Packing Slip
~~Invoice No.~~

Date: November 26, 1985

Terms:

Ship to:

Sold to:

New Brunswick Electric Power Comm.,
Chatham Plant Unit 2,
Chatham, New Brunswick,
Atth: Joe Young, Stores Dept.,
Re:Pilot Dust Collector

Customer Order No.	Date P.O. Received	Contract No.	Reference	Salesman
060-8075			CWF 4/NRC	

Date Shipped	Shipped Via	Partial	Complete	Way Bill No.	Weight	No. of Pieces
26/11/85	Express Freight				8,000 lbs.	

Item No.	Quantity	Description	Unit Price	Qty. Shipped	Amount
1	3	70 Bag Dust Collectors C/W Support Steel in knocked down condition for field assy.			
2	2	Crates (213 cages) for same			
3	4	Cartons of filter bags containing 70 Acrylic and 70 Polyester			
4	1	Daltec exhauster C/W 50 H.P. motor, drives, belts and guard			

ALBARRIE CANADA LIMITED

85 MORROW ROAD
BARRIE, ONTARIO
L4N 3V7
TEL. 705-737-0551
TELEX: 06-875626

SHIP TO:
AIR CORRECTION
282 Belfield Road
Rexdale, Ontario
M9W 1H5 .

DATE SHIPPED:
CUSTOMER ORDER NUMBER: 99-736
CUSTOMER REQUISITION #:
AB NUMBER: 5323

HIPPED VIA: Jackson

SHIPPERS NO.

UANTITY	DESCRIPTION AND SIZE	GROSS WEIGHT	NET WEIGHT	NO. OF CARTONS BALES/REELS
72	AC Filter Bags Size: 126" x 5-3/16" 0 Style: 6530 Finish: AC	135lbs		2

Partial List of Pulse-Jet Installations, In Operation or Under Construction

- Alabama Metallurgical Corp.
- American Can Co.
- Attic Insulation Co.
- Baxter Laboratories, Inc.
- Burlington Industries, Inc.
- Calgon Corp.
- Canadian General Electric Co.
- Canadian Titanium Pigments Ltd.
- Chemical Systems Corp.
- Chicago Adhesive Products Co.
- Chicago Vitreous (Canada) Ltd.
- Commercial Solvents Corp.
- Commonwealth Edison Co.
- Conair Ltd.
- Crouse Hinds Limited
- Deman Construction Co.
- Domglas Co. Ltd.
- DPH Engineering Ltd.
- Dry Milk Products, Inc.
- E.I. duPont de Nemours & Co.
- ESB (Electric Storage Battery)
- Fiberglas Canada Ltd.
- Flintkote Co.
- General Foods Canada Ltd.
- General Motors Corp.
- Guardian Industries Ltd.
- Inland Steel Co.
- International Point Ltd.
- Johns-Mansville Corp.
- Johns-Mansville Canada Ltd.
- Lehigh Valley Industries, Inc.
- Little Crow Milling Co.
- Maple Leaf Mills Ltd.
- M & T Chemical Inc.
- Metrocel Inc.
- Minnesota Mining and Mfg. Co.
- Monarch Fine Foods Co. Inc.
- Monsanto Co.
- John Morrell & Cos.
- National Compressed Air Co.
- Norplex Div., UOP Inc.
- Olin Corp.
- Owens-Corning Fiberglas Corp.
- Pneuveyor Systems Co.
- PPG Industries Inc.
- Pre-Finish Metals, Inc.
- Quaker Oats Co.
- Quebec Iron and Titanium Co.
- Reed Pigment Co.
- Reheis Chemical Co.
- Rockwell International Corp.
- St. Louis Grain Corp.
- Silbrico Corp.
- Sinclair Koppers Co.
- Squibb Corp.
- Stone Container Corp.
- Torrid Oven Co. Ltd.
- Western Perlite Corp.
- Westroc Industries
- Wyler Foods

PILOT BAGHOUSE DEMONSTRATION

AT

N.B. POWER'S CHATHAM T.G. STATION

APPENDIX

SECTION - 16.2

Site Reports covering Demonstration

Week of February - 17 to 21, 1986

Week of February - 24 to 28, 1986

Week of March - 3 to 8, 1986

Project Meeting - March 12, 1986

FILE - CWF 4
- CWF 5
- NRC BURN
- BAGHOUSE TEST

DATE 21 FEB 86

VISIT TO THE CHATHAM GENERATING STATION

NRC DEMO + BAGHOUSE TEST

February 18 to 21, 1986

February 18, 1986

The NRC staff were to optimize their large burners on coal water fuel (air atomized) today. This plan was aborted as a result of a leak in a feed water isolating valve. This problem was discovered while bringing the boiler up to temperature on heavy oil firing.

A meeting was held between the Plant people, CANMET, NRC, PTS and N.B.Power Engineering to review the schedule of events to take place with respect to efficiency tests and baghouse tests as prepared by Mike Thanisch.

The Plant staff had assessed that the leaking valve would be repaired and that operations could resume at approximately 4:00 p.m. of that day.

Adam Bennett of NRC questionned the design of the new primary air collars provided by MBB for the four burners. His concern was that the triangular openings would only provide 5% of the air that normally passed through the primary air passage. In his view, this would limit the output of his burners on coal water fuel. Dr.Kelly Thambimuthu reviewed the air requirements and suggested that these collars should limit the air flow to 30% and to do this, would require the holes to be cut larger. The most expedient way to do this was to cut the larger holes in situ using a power cutting wheel. This required approximately 8 hours for modifying all four burner collars and was completed at approximately midnight. No work could be carried out on gun testing until this work was completed.

The plan of events for Wednesday, February 19th was to commence steaming of the boiler during the 12:00 midnight to 8:00 a.m. shift to allow NRC staff to commence optimization of the CWF guns at 8:00 a.m. and if stable fires are achieved, it was felt that efficiency tests on CWF air atomized as well as a CWF steam atomized could be accomplished by the evening of February 19, 1986.

All of these considerations and plans were made by 4:00 p.m.

In order to gain some time on the test schedule, it was decided to lime the filter bags in the baghouse.

According to Ron Birley of Air Correction, a differential of 3" Wg should be achieved to ensure a proper filter cake is developed on the filter bags. In his estimation, this could be achieved with approximately one hundred and fifty pounds of lime.

Each compartment was individually coated and fifty pounds of lime was used for each compartment. The pressure drops recorded were as follows: 0.5" Wg for the two compartments at each end of the baghouse and 0.2" Wg for the middle compartment.

A visual check was made on the bags and it did appear that the bags were uniformly coated.

February 19, 1986

The boiler was on line at 8:00 a.m. and the NRC personnel began to optimize the CWF burner in No. 4 at approximately 8:30 a.m. Heavy oil was being fired in burners No. 1 and No. 2.

Initially the CWF fire produced some sparklers but after approximately twenty minutes after being placed in operation, the flame although bushy appeared to be brighter and the opacity meter recorded opacities ranging between 20% and 22%.

At 10:20 a.m., burner No.3 was fired on heavy oil to heat up the burner port. This was done to speed up the optimizing time in the setting the burner to CWF firing.

Opacity at this point was just under 20%.

The manual primary air positioner for No.4 is still in the closed position. Adam Bennett felt that the refractory was not sufficiently hot, a situation that would allow the primary air to blow the flame off the atomizer tip. At this point, NRC personnel estmated that the burner in No.4 was producing 42 x 10^6 BTU's/Hour.

At approximately 1:30 p.m., the second CWF gun was fired in No. 3 burner. A poor fire was achieved and considerable bottom ash was being produced. The fluctuation in opacity readings ranged between 20% and 35%. The electrical output was 5.75 MWe.

At 2:00 p.m., burner No. 3 was shut down because of poor fires resulting from fuel plugging. A piece of weld that had broken free jammed between the burner gun and the guide tube which caused a forty-five (45) minute effort to withdraw the gun.

The atomizing cone was replaced and the burner was reinserted into No. 3. Poor flames were still experienced when the gun was forced beyond the 20-25 x 10^6 BTU/Hr. level.

At 5:00 p.m. a decision was made to withdraw the center of the burners in No. 3 and No. 2 and switch them so that the CWF guns would be in burners 2 and 4 and oil guns in 1 and 3. The unit was taken offline and a crew consisting of 2 laborers were directed to make the switch that evening, a procedure estimated to take 3 hours.

It was argued that the unit would be fired up at 6:00 a.m. the next day and that NRC would begin optimizing their first CWF gun at 6:30 a.m. It was determined that this early start would allow for a commencement of a performance run at approximately 10:00 a.m. in the morning.

February 20, 1986

At 6:30 a.m. the coal water fuel gun in burner No. 4 was fired. At approximately 7:00 a.m. the second coal water fuel gun in burner No. 2 was fired. During this time heavy oil was being fired in burners 1 and 3.

The opacity peaked at 40% and the physical appearance of the stack flume looked clean.

At 7:45 a.m. a vacuum problem on the turbine forced the turbine off line.

The boiler was kept at pressure for approximately two hours while efforts were made by the operations staff to locate the problem. After a check on all possible sources of the problem, it was agreed that the isolating valves to the steam air ejectors and the air ejectors themselves would be taken apart and inspected.

At this point it was unknown as to when testing could resume for there was still the possibility that the vacuum problem was in some other area.

The third shipment of coal water fuel arrived at site early this morning. Unloading was delayed until the turbine problem surfaced.

At approximately 11:20 a.m. a baghouse test was conducted with No. 1 unit fans on.

The following measurements were recorded:

BAGHOUSE ONE COMPARTMENT ONLY IN SERVICE

Location: Compartment #1 nearest roadway
Compartment #2 middle one
Compartment #3 nearest river

	COMPT #1	COMPT #2	COMPT #3
Readings From Discharge Ducts on Fan Side of Discharge Dampers	1.7" WG	0.87"WG	1.8" WG
	1.7" WG	1.1" WG	1.9" WG
	1.6" WG	1.1" WG	1.8" WG
	1.6" WG	1.3" WG	1.7" WG
	1.7" WG	1.3" WG	1.7" WG
	1.7" WG	1.3" WG	1.6" WG
Avg. Vel. Head Press.	1.67"WG	1.16"WG	1.75"WG
ΔP (Across Bags)	2.0" WG	0.8" WG	2.0" WG

Static Pressure on Fan Inlet - 6.8" WG
Air Temp - 110°C

BAGHOUSE ALL COMPARTMENTS IN SERVICE

	COMPT #1	COMPT #2	COMPT #3
Readings From Discharge Ducts on Fan Side of Discharge Dampers	0.9" WG	0.65"WG	0.80"WG
	1.1" WG	0.72"WG	0.80"WG
	1.1" WG	0.81"WG	0.79"WG
	1.0" WG	0.90"WG	0.75"WG
	1.1" WG	0.93"WG	0.72"WG
	1.2" WG	0.85"WG	0.72"WG
Avg. Vel. Head Press.	1.07"WG	0.81"WG	0.76"WG
ΔP (Across Bags)	1.5" WG	0.45"WG	1.4" WG

At approximately 6:30 p.m. the turbine was ready to receive steam. The vacuum problem was still there and for approximately one hour the operations people made every effort to find the source of the problem.

At approximately 7:30 p.m. NRC placed the CWF gun in burner No. 2 so as to minimize the consumption of the heavy oil while the operations staff continued searching for the source of the vacuum problem.

Problems were experienced with the CWF gun in service in that its high heat output resulted in the reducing of the heavy oil pressure to 40 psig in order to prevent the steam drum safety valves from staying open (No steam to turbine). The result was high opacity and an unstable condition so both guns were taken out of service.

At approximately 10:30 p.m. a discovery of a leak in the pipe loop on the intermediate steam air ejector was made. At this point it was felt that this was the reason for the vacuum problem. The pipe was removed and was to be replaced and the boiler was to be fired up at 5:30 a.m. tomorrow morning.

February 21, 1986

The operations people were ready to put steam to the turbine at approximately 7:30 a.m. Again, vacuum problems still exist. The boiler was kept ready while further checks were made for leaks around the turbine and condensor.

At approximately 10:30 a.m. the boiler guns were taken out of service.

The plan at this point was to conduct another check on all areas for possible air leakage.

At approximately noon a hole was found in the expansion joint on the atmospheric vent. It was the general consensus that this would not cause the sort of problem that was being experienced, however, the maintenance staff repaired the expansion joint.

Up to this time the strainer baskets had been checked on the water side and were clean, a water seal was manually established in the replacement loop on the intermediate steam air ejector and it was felt that the problem had to be with the first steam air injection loop.

In order to check this area a good portion of the remaining day would be required. With the consideration of the operations personnel available, and the uncertainty of the turbine availability, it was agreed to send the efficiency people home.

Work would proceed relative to seeking out the turbine problem and relative to the burner modification work by Dr. Kelly Thambimuthu over the weekend.

Contact would be made between N.B. Power head office and the plant on the progress of the solution to the turbine problem and a direction on the course of the program would be made Monday, February 24, 1986.

Kenneth C. Brown

Kenneth C. Brown

File: CWF 5 - CWF 4
- Chatham Baghouse Test
- NRC Burner Test
Date: 27 Feb. 86

Report on Visit to the

Chatham T. G. Station

Date of visit: 24 to 26 February, 1986

Reason for visit: Testing of NRC/EMR burners and new baghouse

Details of visit:

Review of the First Week of Testing (18 to 21 Feb. 86)

First thing Monday morning (Feb. 24/86) I went into Head Office so that I could obtain a report from Ken Brown on what had been achieved at the Chatham Plant the week of February 18 to 21-1986 (I had been unable to go to Chatham myself because of illness).

Basically no testing had been done because on Tuesday (Feb. 18/86) the operators could not put the unit into service because of a problem with a feed water valve. On Wednesday (Feb. 19/86) after the valve had been repaired, the unit was in service for a short time but had to be shut down again because of a loss of vacuum in the turbine condenser, and the turbine started to overheat.

It was late Friday evening (Feb. 21/86) before the problem with the condenser vacuum was corrected and the unit put back into service. By this time the test crew had returned to Fredericton because it was too late that week to undertake a test program. The NRC crew ran two of their large guns for a few hours on Friday evening to try and obtain the settings which would give the best performance for their guns - when burning the new coal water reel (CWF).

Some air flow tests of the baghouse had been conducted and the bags had been coated with lime.

No burner testing was carried out over the weekend but on Sunday a new sleeve was installed in the throat of the number one burner.

Monday, Feb. 24 - 1986

Once the unit No. 1 boiler was in service on Monday morning (Feb. 24/86) a NRC gun was tested in the modified No. 1 burner. By the time I arrived at the Chatham plant, they had the following burners in service:

burner No. 1 - NRC gun burning CWF in the modified No. 1 burner throat

burner No. 2 - heavy oil with Forney gun

burner No. 3 - heavy oil with Forney gun

burner No. 4 - NRC gun burning CWF

The operators were having a problem maintaining the required atomizing air pressure to the NRC guns and felt the low pressure was being caused by a problem with the air compressor. They requested permission to obtain a second compressor to try and overcome the problem. The Chatham plant stores were requested to have another compressor delivered right away.

The second compressor was on site by 4 pm but the wrong hose fittings had been sent, and it was 5 pm before the compressor was in service and the required atomizing air pressure obtained.

Not all the afternoon was lost, as the 125 CFM in plant compressor was used for a short time, until it started to overheat.

Once two CWF guns were in service without any support firing from either the light oil ignitors or heavy fuel oil guns, it was decided to put the baghouse in service. Unfortunately, the motor could not be started because the plant electrician had been working on the electrical breakers and had left the one which feeds to the baghouse motor in the open position.

By 6:30 pm the opacity had gone to 60% reading (not corrected for the unit No. 2 fans) so an oil gun had to be put back into service.

The following readings were taken at the unit No. 1 burner front.

Burner No. 1 -	CWF	- 85 psig
	Atomizing Air	- 115 psig
Burner No. 2 -	CWF	- Not in Service
	Atomizing Air	- Not in Service
Burner No. 3 -	Heavy Oil	- 65 psig
	Atomizing Air	- 102 psig
Burner No. 4 -	CWF	- 65 psig
	Atomizing Air	- 112 psig

Opacity reading 38% (not corrected for No. 2 fans)

At 6:45 pm the oil gun was taken out of service and the opacity reading went up to 48%.

The baghouse was put into service and the opacity reading dropped over 10%. The baghouse was kept in service for approximately half an hour, and the pressure drop across the baghouses increased 1/2" water gauge (WG). The baghouse was in service again from 7:45 pm to 8:05 and again the opacity reading dropped 10%.

During both of the baghouse tests, the boiler operators were experiencing problems maintaining stable CWF fire without any support oil guns in service. (The baghouse had nothing to do with this.)

At 8:15 pm the unit was shutdown for the day and a meeting was held in Don MacDonald's office to review the day's work. The following people were present:

Don MacDonald - NB Power Chatham
Keith Keoughan - NB Power Chatham
Kelly Thambimutha - EMR Canmet
Adain Bennett - NRC
Floyd Toll - NRC
Hedley Smith - MBB Halifax
Mike Thanisch - NB Power Fredericton

NRC people reported they felt they had obtained fires as good as possible with the new coal water fuel, but the fires were not as good as the ones obtained in the fall of 1985. They felt they should be able to repeat the same firing the next day.

·Kelly Thambimuthu reported he was pleased with the improvements that had been obtained with the fire in the No. 1 burner after the throat modifications had been made.

It was generally agreed the Efficiency group should return to the Chatham Plant the following day to undertake this test program.

Phone calls were made to both Dave Rankin and Wayne Davies in Fredericton to arrange for the test to be conducted the next day.

There were two reasons to conduct the test as soon as possible:

1) The new fuel was degenerating, the viscosity was dropping while the moisture level was constant.

2) The unit No. 1 boiler would not be available after Thursday (Feb. 27/86) for a minimum of four days because a hydro test was being conducted on the Unit No. 3 boiler, and no water would be available for Unit No. 1 boiler.

Tuesday Feb. 25, 1986

Everyone was at the plant by 8 am and at 8:15 am Dave Rankin was called again to ensure the test group would return to the Chatham Plant that day to undertake the efficiency tests of the unit No. 1 boiler. The tests would be conducted while burning the new coal water fuel, with the two large NRC guns in operation with both atomizing air and steam. A third efficiency test with the two NRC guns burning heavy oil would be conducted.

Later we were told two people from the test group would be in Chatham after lunch to conduct a shortened efficiency test on the unit No. 1 boiler.

All morning was spent trying to obtain at least the same level of combustion that had been obtained the day before with the new fuel and the NRC guns. The viscosity of the fuel had dropped further overnight; even though it had only been recirculated for an hour on the night shift; to ensure the fuel lines did not become plugged with settled CWF.

8:45 am - Hedley Smith and I inspected the filter bags in all three baghouses and it was noted a good cake, about 1/4" thick (0.6 cm) had built up on all the bags.

10:36 am - Bughouse was put in service, and the pressure drop across each baghouse was recorded throughout the day.

11:26 am - The light oil ignitor was removed from the No. 1 burner which had the NRC gun in it burning C.W.F. The opacity reading was 25%.

12:24 pm - The second NRC gun with CWF was put in service in the No. 4 burner.
- The flame was unstable.

12:30 pm - The NRC gun in burner No. 4 was removed.

12:36 pm - More adjustement made to burner No. 1.
- The opacity reading was 18%.

12:38 pm - No. 4 burner back in service with CWF and a light oil ignitor.

1:04 pm - Ignitor removed from burner No. 4
- The fire is quite good
- Opacity reading 29%

1:07 pm - The ignitor had to be put back in burner No. 4.

Note - The two people from the efficiency group arrived at lunch time at the Chatham plant.

1:40 pm - burner No. 1 - CWF
- burner No. 2 - heavy oil
- burner No. 3 - not in service
- burner No. 4 - CWF with a light oil ignitor

1:50 pm - CWF fires became unstable
- Two heavy oil guns put in service.
- Min. load on the unit.
- Problem with the CWF check valve

3:00 pm - CWF system back in service.

3:06 pm - No. 1 burner back in service with CWF with a light oil ignitor.
- Opacity reading 10%.

3:10 pm
- Burner No. 4 back in service with a light oil ignitor
- opacity reading 18%

4:05 pm
- CWF gun removed from burner No. 1 because of a larger number of sparklers (fire flies) in the furnace.
- It was found part of the No. 1 atomizer tip had been lost.
- This was a thin wall tip that was being tested.
- The atomizer tip was replaced.
- CWF guns back in service.

5:00 pm
The first efficiency test was started:
- Two CWF guns with air atomization
- Burner No. 1 - CWF
- Burner No. 2 - not in service
- Burner No. 3 - not in service
- Burner No. 4 - CWF with an ignitor

6:00 pm
- First test completed
- Burner No. 1 switched to steam atomization
- Problem obtaining the required steam pressure at the gun
- The auxiliary steam header pressure was increased to 140 psig
- The pressure at the gun did not increase, it was felt there was too much steam flow through the NRC gun
- The steam passage was partly closed
- It should be noted this was the first time the new large NRC guns had been used with steam atomization
- Finally the No. 1 burner was in service with CWF and steam atomization
- Many attempts were made to obtain stable fires in the No. 4 burner but acceptable fires could not be obtained

7 to 7:30 pm
- Short/part test on Steam/air atomization
- Test with CWF
- Burner No. 1 - CWF with steam atomization
- Burner No. 2 - not in service
- Burner No. 3 - not in service
- Burner No. 4 - CWF with air atomization and a light oil ignitor

7:30 pm
- Steam Atomization Test halted

7:40 pm
- No. 1 burner switched back to air atomization

7:45 pm
- Baghouse cleaned with the pulse jets while the fan was running
- No. 1 Baghouse took some time to drop from 6.6"WG to 3."WG
- No. 2 Baghouse also took some time to drop from 5.4"WG to 2.5"WG
- No. 3 Baghouse dropped very quickly from 6.3"WG to 2."WG

NOTE - When the fly ash was dumped from the baghouse hoppers down into the drums, the drums overfilled making quite a mess in the fan floor area.

8:00 pm
- Started to switch the two NRC guns over to Heavy oil firing
- Burner No. 1 brought into service with heavy oil and the ignitor was removed
- The flame seemed quite good for a while and then very quickly the flame was lost and the ignitor was put back in Burner No. 1
- No. 4 burner put in service with heavy oil

8:25 pm - Both light oil ignitors were removed.

8:30 to 9:00 pm

- some adjustments were made to burner No. 4 to pull the flame back to attach it to the burner (gun)
- Unit No. 2 boiler fans shutdown
- Opacity reading 6%

9:30 pm
- The third NRC gun/atomizer test start while burning heavy oil with steam atomization
- Steam for 50,000 lbs/hour

10:00 pm - Heavy oil test completed

10:10 pm
- Unit No. 1 shutdown
- there was only about 10 tons of CWF left in the barker

Wednesday - Feb. 26/86

The baghouse could not be opened to inspect the bags because there was a very heavy snow fall, and it was felt the fly-ash cake on the bags would get wet if it was exposed to the snow.

Monday - March 3/86

The bags were inspected while conducting a tour of the plant and new baghouse for Dr. Phil Roall of EMR, and Dr. Horace Whaley of EMR CANMET.

- The bags in the No. 1 Baghouse still had quite some larger buildups of fly-ash in places on them. They had been cleaned with the pulse jets air supply set at 55 psig.

- The bags in the No. 2 Baghouse were quite clean. They had been cleaned with the pulse jets air supply set at 100 psig.

- The bags in the No. 3 Baghouse also had quite a buildup on them in places. They had been cleaned with the pulse sets air supply set at 100 psig.

NOTE-Further testing of the NRC guns and the baghouse could not be under taken until both more CWF had been received from CBDC in Sydney NS, and the Hydro tests had been completed on the Unit No. 3 boiler.

Pump Test

- An air operated diaphragm pump was tested, for handling coal water fuel while it was being unloaded from the delivery trucks.

  This pump did not work well and would not pump the CWF up into the Chatham in-plant storage bunker while working on its own. For this reason it was only used to supply CWF the transfer pump located in the Chatham Plant Basement.

  It was felt the problem with the pump was caused by the air discharge port on the pump freezing up.

Prepared by

M. R. Thanisch

M. R. Thanisch

File: CWF 4 NRC Gun Test
CWF 5 Baghouse Test

1986-03-10

VISIT TO THE CHATHAM PLANT

DATE:	Wednesday, March 5 to Saturday, March 8, 1986
REASON:	Testing of the Modified NRC Gun and Burner, and Testing of the Baghouse.

DETAILS OF VISIT:

Wednesday, March 5

- I arrived at the Chatham Plant at 10:15 a.m. Kelly Thambimuthu of EMR had arrived on Tuesday and had the larger sleeve installed in the No.1 burner throat.

- Hedley Smith arrived from Halifax about 9:30 a.m. While the No. 1 unit was being brought on line, a leak developed in the boiler feed pump packing and the unit had to be shutdown to correct the problem.

- Hedley, Kelly and I inspected the baghouse and took some pictures of the bags.

  1. 3 pictures of the fiberglass bags.
  2. couple of the polyester bags.
  3. couple of the nomex (white spot) bags.

- Some pictures were also taken of baghouse. The baghouse door were closed and the pulse jet cleaning system put in service, after about ten minutes the baghouse were opened and the bags inspected again. This time, all the bags were free of any build-up and the fiberglass bags still had some lime on them (the bags are black) but as the other two (2) sets of bags are white so it was impossible to tell if there was any lime left on them.

- At 11:45 a.m., the operators started to put the unit into service, as the boiler feed pump packing had been replaced.

12:20 p.m. - Call from Dave Lawrence on operating the Baghouse

1. Clean the bags when the pressure (PD) builds-up to 4" to 5"
2. Continue cleaning the bags until the pressure drop goes down to 2" to 3"

3. Let PD build up to 4" to 5" again before cleaning
4. Clean fiberglass off line.
5. Long term blinding, PD will continue to increase and not drop back after cleaning.
6. Pulse the bags for ½ hour with clean dry air before long term shutdown.
7. Nomex may be subject long term acid attack - remove and clean before long term shutdown.
8. Pulge 50 to 75 millisec., with 7 to 10 seconds between pulses, when cleaning while the baghouse is in service; off line cleaning change to 5 seconds between cleaning.

1:30 p.m.

- The boiler was up to temperature and pressure and the operators started to roll the Unit No.1 turbine.

2:00 p.m.

- Turbine up to speed and unit on line. No.1 and No.3 guns in service on heavy fuel oil.

2:10 p.m.

- Adam Bennett and Floyd Toll of NRC in Ottawa arrived.
- There was no chart paper in the opacity meter. It has been on order for some time but it had not arrived.
- Some Foxborough paper that was the same width was used. The only problem was the sproke holes were on a different pitch.

2:20 p.m.

- No.1 oil gun switched to burner No.2 so that an NRC gun could be installed in the modified burner No.1.

2:35 p.m.

- 3 bags of lime (150 lbs.) were added to baghouse. The 'PD' came up to:
  1. 0.55" WG
  2. 0.3" WG
  3. 0.6" WG

- This was done with the inlet damper closed (just leakage) and air through 3" pipe nipple where lime was added.

3:05 p.m.

- Burners in-service
  Burner No.1 - ignitor only
  Burner No.2 - heavy fuel oil (HO)
  Burner No.3 - heavy fuel oil (HO)
  Burner No.4 - No gun ready for CWF

- Held up waiting for air supply to the NRC station, at No.4 burner.

- opacity reading 3%

3:10 p.m.

- Operator ready to put an NRC/CWF gun in burner No.1.
- Unit No.2 boiler fan put in service to dilute the flue gas from No. 1 boiler.

- Burners in-service

Burner No.2	H. Oil	58 psig
	A.Steam	60 psig
Burner No.3	H. Oil	75 psig
	A.Steam	75 psig

3:15 p.m.

- Burner CWF check valve plugged, so the NRC gun cannot be put in service.
- The NRC guns had to be steam cleaned because they had some heavy oil deposits still in them from last week's test program.

3:25 p.m.

- The CWF pump has been shutdown so the plugged check valve can be cleaned.

3:30 p.m.

- CWF system back in service, and ready to put the NRC gun in No. 1 burner with coal water fual (CWF).

3:40 p.m.

- Unit shut down because of a salt leak into the turbine condenser.

4-5:00 p.m.

- I took a visitor from the Iron Ore Company of Canada, Tom Martinovic for a tour of the Unit No.3 fluidized bed boiler project. The two chaps from NRC in Ottawa came along.

Overnight

- The maintenance crew will work the night shift to find and repair the condenser leaks.

Thursday, March 6

- The condenser leak was repaired overnight.

4:45 a.m.

- The operations started to steam the boiler.

7:00 a.m.

- When the operators tried to come on line with the No. 1 Unit, it was found some of the boiler feed pump control lines had frozen.

- The Unit No.3 construction crew had left the temporary access door to the basement open allowing cold air in, which froze the line.

8:00 a.m.

- I arrived at the plant and after being told of the problem, I visited the maintenance and construction crews to ensure the problem was being corrected.

9:00 a.m.

- The unit operators started to steam up the unit No.1 boiler again.
- All 4 ignitors in service.

9:15 a.m.

- H.Oil gun in service in burner No.1.

9:30 a.m.

- H.Oil gun in service in burner No.2.
- H.Oil gun in burner No.1 switched to burner No.3.

10:30 a.m.

- Started roll turbine.

11:00 a.m.

- Turbine coming up to speed.
- 3 HO guns in service.

11:05 a.m.

- Unit No. 1 on line.

11:25 a.m.

- No.1 burner in service, with the CWF and atomizing air (A. Air) supplied from the NRC manifold.
- Opacity reading 30%.

11:27 a.m.

- Ignitor removed from the No.1 CWF burner.
- Opacity reading dropped to 25%.

11:35 a.m.

- Baghouse in service.
- Baghouse test resdings - pressure drop (PD)

	11:35 a.m.	12:25 p.m.	1:45 p.m.	After Cleaning	Number Air Cycles
Baghouse 1 -	2.4" WG	4.0"	4.9"	3.7"	3 full
Baghouse 2 -	1.1" WG	2.6"	3.4"	1.2	1 full
Baghouse 3 -	1.3" WG	3.4"	4.3"	2.0	2 full

- Opacity Reading - 15% (at 11:35 a.m.)

12:00 noon

- Opacity reading jumped up to 30%. Secondary air (windbox) pressure decreased and the opacity reading came down 20%.
- Steam Flow 25,000 lbs/hr.

12:10 p.m.

- Burner No.4 ignitor in service.
- All lines have been checked and cleaned.
- NRC gun moved into position.
- Opacity reading 15%.

12:15 p.m.

- NRC gun in service in No.4 burner with a light oil ignitor.
- Opacity reading 24%.
- Burner front flows and pressures readings

Burner No.1 CWF	90 psi	A.Air 80 psi - Air flow 140 CFM
Burner No.2 H.Oil	57 psi	A.Steam 68 psi
Burner No.3 H.Oil	60 psi	A.Steam 80 psi
Burner No.4 CWF	60 psi	A.Air 85 psi

12:25 p.m.

- Baghouse "PD' taken (see table).
- Opacity reading 20%.

12:30 p.m.

- Opacity reading 25%.
- Adjustments made to the NRC gun in burner No. 1.

NOTE:
- This morning, the No.1 burner has the new large sleeve in the burner throat.
- The flame is smaller and quite ragged.
- Unburnt fuel is building up on the throat.
- Kelly is having to relearn how to shape the CWF flame with the large throat.

12:35 p.m.

- The ignitor was put back in the No.1 burner to try and remove the build-up.
- Opacity reading 28%.

2:15 p.m.

- The amount of fly ash in the drums was checked:

From Baghouse No.1 - 2/3 full
From Baghouse No.2 - 1/6 full
From Baghouse No.3 - 1/3 full

2:30 p.m.

- Burner front flows and pressures.
  No ignitors in service.

Burner No.1 - CWF	90 psig	A.Air = 102 psig	Air flow = 140. CFM
Burner No.2 - H.Oil	63 psig	A.Steam = 74 psig	
Burner No.3 - Not in service			
Burner No.4 - CWF	60 psig	A.Air = 90 psig	

- Opacity reading 27%.

- Opacity went up about 3% when the No.3 oil gun was removed.

- Load on unit before the oil gun was removed 100,000 lbs/hr.

- Load on unit after the oil gun was removed 85,000 lb/hr.

2:40 p.m.

- Increased the speed of the air compressor to maximum.
- Burner - No.1 CWF 95 psig A.Air 116 psig Air Flow - 145. CFM
- Atomizing air pressure lost.

2:46 p.m.

- Opacity reading 30%.
- Air pressure back-up to pressure.
  Burner front flows and pressures readings

Burner No.1 CWF-81 psig	A.Air 100 psi	Air Flow = 140 CFM
Burner No.2 Oil-73 psig	A.Steam 104 psi	
Burner No.3 Not in service		
Burner No.4 CWF-90 psig	A.Air 120 psi	

Baghouse Test PD Readings

	3:40 p.m.	4:00 p.m.	4:22 p.m.	4:30 p.m. After Cleaning
Baghouse No. 1 -	4.9"	5.1"	5.1"	3.0" - Three full cycles
Baghouse No. 2 -	2.4"	2.8"	2.9"	1.0" - One full cycle
Baghouse No. 3 -	4.25"	4.4"	4.5"	4.9" - Five full cycles

3:45 p.m.

Velocity Pressures in the Three 16"Ø Discharge Ducts from Baghouse

Traverse Points Across Duct	No.1 Duct	No.2 Duct	No.3 Duct
1"	0.36	0.47	0.30
2"	0.40	0.49	0.40
3"	0.45	0.51	0.45
4"	0.45	0.55	0.48
5"	0.46	0.66	0.50
6"	0.45	0.68	0.50
7"	0.45	0.69	0.49
8"	0.44	0.71	0.47
9"	0.425	0.72	0.45
10"	0.42	0.72	0.45
11"	0.425	0.71	0.44
12"	0.415	0.66	0.44
13"	0.41	0.62	0.43
14"	0.4	0.59	0.42
15"	0.36	0.50	0.40
16"	0.29	0.40	0.30

All readings in inches water gauge

Gas Temperatures and Velocities

Discharge Duct From Baghouse	Temperatures		Velocity (Approximately)
No.1	149°C	300°F	3100 fpm
No.2	149°C	300°F	4050 fpm
No.3	149°C	300°F	3350 fpm

Static Pressures

Inlet Header to Baghouse Before Cleaning Bags = 1.3"WG
Inlet Header to Baghouse After Cleaning Bags = 1.7"WG

Inlet Duct to Fan Before Cleaning Baghouse = 8.6" WG
Inlet Duct to Fan After Cleaning Baghouse = 7.9" WG

4:47 p.m. - Pressure Drop Across Baghouse

Baghouse No. 1-3.8" WG
Baghouse No. 2-1.4" WG
Baghouse No. 3-2.7" WG

5:25 p.m. - Velocity Pressures in the Main Boiler No. 1 Breeching

Wall = 0.06" WG
12" = 0.1" WG
24" = 0.1" WG
36" = 0.11" WG
48" = 0.11" WG

Size of Breeching 5' x 7' - 6 (60" x 90")

Velocity Pressures in the Three 16"0 Discharge Ducts After Cleaning Bags

Traverse Points Across 16"0 Ducts	No.1	No.2	No.3	
1"	0.39	0.36	0.55	
2"	0.50	0.40	0.65	
3"	0.57	0.46	0.71	
4"	0.60	0.55	0.73	
5"	0.61	0.59	0.74	
6"	0.61	0.65	0.74	
7"	0.59	0.70	0.72	
8"	0.58	0.75	0.70	All reading in inches Water Gauge ("WG)
9"	0.575	0.77	0.67	
10"	0.565	0.80	0.67	
11"	0.55	0.79	0.66	
12"	0.55	0.77	0.655	
13"	0.55	0.76	0.65	
14"	0.56	0.74	0.63	
15"	0.53	0.65	0.58	
16"	0.40	0.57	0.50	
Gas Temperatures	151°C	151°C	151°C	

Static Pressures

Inlet Header to Baghouse = 1.6" to 1.8" WG
Inlet Duct to Fan = 8.1" WG

5:00 p.m. - Fly Ash in Drums: (The drums had been emptied after the 2:30 p.m. bag cleaning)

From No. 1 Baghouse 1/3 full
From No. 2 Baghouse 1/6 full
From No. 3 Baghouse just enough to cover the bottom of the drum

5:40 p.m.- Static Pressures

- Inlet Header to baghouse - 1.7" WG
- Inlet Duct to fan 8.45" WG

5:55 p.m.

- CWF in Burners No.1 and No.4 with no ignitors.
- Ignitor put in burner No.2 and the oil gun removed.
- Opacity reading - 35%.

6:05 p.m.

- Both CWF guns firing at 42 x 10^6 BTU.
- No.1 clean and bright.
- No.4 bright but some fire flyes.
- Both guns have bushy fires.
- Steam flow 85,000 Lb/hour.

6:10 p.m.

Inspection of Ash Pit

- There is a small amount of very fine fall out and, now and again a small burning lump of fuel is coming down.
- There is a light cover of dust on the bottom of the furnace floor - but one can still see the shape of the water tubes.
- There is a small pile of burning ash/fuel below the burners.

NOTE:
- Kelly said he felt the smaller sleeve he used in the burner throat last week worked the better than the large one now in No. 1 Burner.

6:15 p.m. (5:15 p.m. in Ottawa)

- I tried to return Bill Pearson's call but there was no answer.

6:20 p.m.

- Load on unit - 6.2 MW
- Steam Flow 85,000 lb/hr.

6:45 p.m.

- No.1 CWF gun removed because fire unstable.
- The gun had been in service since 11:25 a.m. 7 hours, 20 minutes.
- Oil gun in service load on unit dropped 3 MW (+ tank heaters).
- The load had been 6.2 MW with two CWF guns + one ignitor.

7:02 p.m.

Static Pressures

- Inlet Duct to fan 8.9".
- Inlet Header to baghouse 1.5".

Pressure Drop Across Baghouse

Baghouse No. 1	5.4"	3.0" After cleaning with 4 cycles
Baghouse No. 2	2.8"	1.0" After cleaning with 1 cycle
Baghouse No. 3	4.7"	2.0" After cleaning with 2 cycles

Checked fly ash drums:

From No. 1 Baghouse - little change since 4:30 p.m.
From No. 2 Baghouse - 3" deep in bottom of drum
From NO. 3 Baghouse - too much dust to see what is in the drum

7:08 p.m.

- No.1 CWF gun back in service.
- Small pieces of rubber were found in the No.1 CWF gun atomizer tip.
- These were removed and the gun returned to service.

7:30 p.m.

Fan motor current - 25.7 Amp
Power = Volts x Amps
575 x 25.7 = 14.78 Kw = 19.8 HP

7:40 p.m. - Burner front flow and pressure readings

Opacity reading - 30%.

Burner No.1 - CWF 110 psig	A.Air 105 psig	Flow 135 cfm
Burner No.2 - Oil 65 psig	Steam 90 psig	
Burner No.3 - Not in Service		
Burner No.4 - CWF 89 psig	A.Air 110 psig	

7:48 p.m.

- Ignitor put in No.1 burner.
- Atomization changed to steam from air.
- Opacity jumped because of loss of steam to the oil gun.
- This was corrected and the opacity dropped back 35%.

- No.1 ignitor removed.
- Burner front flows and pressures readings

Burner No.1 - CSF 78 psig	A.Steam 85 psig, Temp.155°C, 310°F
Burner No.2 - Oil 57 psig	A.Steam 82 psig
Burner No.3 - Not in Service	
Burner No.4 - CWF 80 psig	A.Air 120 psig

- Opacity reading dropped back to 30% when the ignitor was removed.
- Kelly thinks the flame looks a little more ragged with steam atomization but the flame is still very bright.

8:00 p.m.

- There is still a very fine and slow build-up of ash in the bottom of the furnace but there is no burning.

8:05 p.m.

- No.1 burner fire clean and bright - no sparkers.
- No.4 also looks good with A.Air.
- Opacity reading 32%.
- Load on unit - 6.0 MW.
- Steam pressure - 600 psig.
- Steam temperature - 750°F.

Bunker Outage	2:20 p.m.	17' - 10"	- 14,000 im gallons (imp)
	4:30 p.m.	18' - 9 1/2"	- 12,250 im gallons (imp)
	7:35 p.m.	20' - 1 3/4'	- 10,100 im gallons (imp)
	9:20 p.m.	21' - 1 1/2"	- 8,600 im gallons (imp)

8:25 p.m.

- Lost atomizing air flow to No.4 gun - No.4 gun removed.

8:35 p.m.

- The air compressor was overloading and shutting down. The operator opened a bleed valve and No.4 gun was returned to service.

9:00 p.m. Baghouse Test

Baghouse PD's:

Baghouse No. 1	5.4 down to 3" in three minutes with pulse jets in service cleaning bags.
Baghouse No. 2	2.5 down to 1" in one minute with pulse jets in service cleaning bags.
Baghouse No. 3	4.6 down to 2" in two minutes with pulse jets in cleagning bags

9:15 p.m.

- Oil gun put in No.3 burner.

9:20 p.m.

- Bunker 21-1½" - 8,600 gallong (imp)

- Since 7:35 p.m. (1 hour - 45 minutes), 1500 gallons have been burnt. This is equal to 857 gph.

9:42 p.m.

- Opacity 30%.
- Load on unit - 5 MW.
- Steam Flow 90,000 lb/hr.

9:55 p.m. - Burner Front Flow and Pressure Readings

No.1 CWF 88 psig	A.Steam 110 psig, Temp.330°F
No.2 Not in Service	
No.3 Oil 60 psig	A.Steam 96 psig
No.4 CWF 85 psig	A.Air 105 psig

- Opacity reading 32%.
- Load on unit - 5.5 MW.
- Steam Flow 98,000 lb/hr.

10:10 p.m. Baghouse Test

Baghouse No. 1	4.9" - after cleaning 3.4"	- cleaned at 10:22 p.m.
Baghouse No. 2	2.0" - not cleaned	
Baghouse No. 3	4.5" - after cleaning at 3.3"	

10:30 p.m.

- Checked fly ash drums.

From No.1 Baghouse - 2/3 full
From No.2 Baghouse - 1/3 full (bag not cleaned)
From No.3 Baghouse - over 2/3 full plus a large amount on floor from leakage from top of slide knife gate valve (the ash must have been hanging up in the hopper)

10:35 p.m.

- No.4 CWF gun switched to atomizing steam but the opacity went up so it was switched back to atomizing air.

10:43 p.m.

- No.2 gun removed. No.2 gun had been used to maintain an atomizing air flow.

10:50 p.m.

- Bunker 21'-11½" outage = 7,500 imp.gallons.

11:15 p.m.

- Pressure drops across baghouse:

Baghouse No.1	4.8" WG
Baghouse No.2	2.6" WG
Baghouse No.3	3.8" WG

- Pulse jets put in service on No.1 and No.3 for a few minutes.

11:22 p.m.

- Burner No.1 has developed a number of "fire flies". The flame is so big and bright it is hard to see the burner throat to see if there is a build-up.
- The windbox pressure reduced to 1.3 from 1.5.

11:25 p.m.

- Opacity reading - 78%. (This was just a short swing)
- No.1 fire has improved.
- It could have been a fuel problem.

11:28 p.m.

- Opacity reading - 17%

11:30 p.m. - Burner Front Flow and Pressures Readings

Burner No.1 - CWF 75 psig	A.Steam 95 psig	Temp.320°F
Burner No.2 - Oil 75 psig	A.Steam 95 psig	
Burner No.3 - Oil 55 psig	A.Steam -100 psig	
Burner No.4 - not in service		
Steam Flow - 85,000 Lbs/hour		

12:00 Midnight

- No.1 gun with CWF will be left in service at 43 x 10^6 BTU all night with two oil guns at light load to keep the heat up in the boiler.
- The baghouse will also be left in service.

Friday, March 7

7:30 a.m.

- No. 1 Burner in service all night (with no ignitor) and steam atomization.

- This Burner has been in service for 12 hours with steam atomization, plus 8 hours on air atomization for a total of 20 hours continuous service.
- The opacity reading was steady all night at 28%.
- The steam flow was held at 75,000 Lb/hour at night.

8:15 a.m.

- No.4 gun in service with CWF with a light oil ignitor.

8:30 a.m.

- No.4 ignitor removed.
- Opacity reading - 40%.

8:40 a.m.

- Current to baghouse fan motor = 25.4 Amps.

9:17 a.m.

- No.3 H.Oil gun removed.

9:45 a.m. - Steam Flow 100,000 lb/hr.

10:00 a.m.

- Bunker 27'-3¼" outage = 15 tons approximately.

NOTE: This morning I took a number of pictures of the burner No.1 fire. Some from the back of the boiler and some from the ash pit door.

10:30 a.m. Baghouse Test

Inlet Duct to Fan — Sets of Readings

Test Points	1st	2nd	3rd
Wall	0.85	0.75	0.85
4"	0.87	0.72	0.85
8"	0.75	0.50	0.70
12"	0.50	0.30	0.47
16"	0.30	0.29	0.25
20"	0.23	0.33	0.24
24"	0.35	0.37	0.30
Far Wall	0.35	-	0.57

Inlet Header to Baghouse

Test Points			
Wall	0.02	0.50	-
6"	0.60	0.10	0.01
12"	0.15	0.20	0.03
18"	0.30	0.35	0.35
24"	0.35	0.45	0.52
30"	0.25	-	0.35

All reading in inches of water gauge.

11:05 a.m. Main Breeching

	Traverse	
	1st	2nd
Wall	0.05	0.05
12"	0.08	0.09
24"	0.09	0.10
36"	0.095	0.10
48"	0.10	

11:15 a.m. - Static Pressure in Breeching - 0.50" WG
- 0.55" WG

11:20 a.m. Static Pressures

Centre baghouse damper closed.

Inlet header to baghouse - 0.8" WG
Inlet duct to fan - 9.0" WG

11:22 a.m. Pressure Drop Across Baghorses

Baghouse No. 1	6.2"
Baghouse No. 2	out of service
Baghouse NO. 3	5.6"

- Opacity jumped up then settled back to 30%.

Pulse Jet Timer switched on:

Baghouse No. 1 one cycle down to 5"
Baghouse No. 3 two cycles down to 3.5"
Baghouse No. 1 after 3 to 4 minutes to 4.6"
Baghouse No. 3 after 3 to 4 minutes to 3.2"

11:30 a.m.

Ash drum: (The drums were emptied overnight)

From No. 1 Baghouse	- very little
From No. 3 Baghouse	- over 2/3 full

11:45 a.m. - Burner front flows and pressures readings

Burner No.1 - CWF 73 psig	A.Steam 90 psig	Temp.of Steam 315°F
Burner No.2 - Oil 75 psig	A.Steam 80 psig	
Burner No.3 - not in serice		
Burner No.4 - CWF 80 psig	A.Air 110 psig	

- Opacity reading - 30%.
- Steam flow - 75,000 lb/hr.

11:50 a.m.

- Burner No.1 has now been in service for 24 hours without an interruption (Except to remove some small pieces of rubber) including 16 hours with atomizing steam. The fire still looks bright and stable with no fire flies.
- Burner No.4 in service with no ignitor and air atomization.

11:57 a.m.

- Lost No.4 CWF gun.
- No light oil pressure so an ignitor could not be put in.
- The pump had been shut down because it was not being used and when the operator went to start it, the prime had been lost.

NOTE: At 11:00 a.m., the bunker was gauged at 28'-10" appriximately 11 tons (1800 imp.gal).

12:05 noon

- Ignitor back in burner No.4.
- No.4 CWF gun back in service.
- Opacity - 45%.

12:20 p.m. Pressure Drops Across Baghouse

Baghouse No.1 - 6.2"	4.5" (after cleaning for 3 minutes)
Baghouse No.2 - not in service	
Baghouse No.3 - 5.7" alot in service	3.1" (after cleaning for 2 minutes)

12:25 p.m.

I tried to call Lloyd Tozer on PEI but he was not in because of the snow storm.

12:40 p.m. Baghouse Test

Static Pressured

Inlet header to baghouse - 0.8"
Inlet duct to fan - 8.6"

Pressure Drops Scross Baghouse

Baghouse No.1 - 5.4"
Baghouse No.2 - out of service
Baghouse No.3 - 4.9"

12:54 a.m. - No. 4 gun becoming unstable as the bunker is burnt down.

1:10 p.m.

- Unit No. 1 shutdown because all the CWF in the bunker had been burnt.

2:20 p.m.

- Baghouse inspected.
- No.2 (polyester) bags checked, these bags had failed.
- This had been shown by:

  1. - no increase in pressure drop (PD)
  2. - when the bags were purged with air, the PD dropped to 0.5" WG
  3. - pieces of the bags were found in the ash drum.

- The No. 2 baghouse had been taken out of service before the end of the test program. On inspection, the bag looked quite clean and there was no noticeable build-up on them. No pictures were taken.

- No.3 bags (Nomex) were checked and there was quite a build-up on the bags. The pulse jet cleaning was put in service and the bags cleaned quite well. The 'PD' could not be checked because the fan was not in service.

- The No. 1 bags (fiberglass) were checked and there was some build-up on the bags - not as much as the Nomex. This build-up would not fall off the bag as easily as the No.3 (Nomex) bags when they were manually banged. Three pictures were taken. The pulse jet cleaning was put in service but again, the deposits did not come off readily.

- The baghouse doors were closed.

2:45 p.m.

- The pulse jet cleaning had been in service for 25 minutes. The Nomex bag still had a thin film on them which could be brushed off by hand but the pulse jets would not remove it. The fiberglass looked clean. The baghouse fan was restarted to check the pressure drop across the bags.

  No.1 - 2.3"
  No.2 - out of service
  No.3 - 1.6"

- The fan was shut down.
- One of the polyester bags from baghouse No.2 was removed and the material was found to have become very soft with no strength.
- The hoppers were dumped. There was too much of cloud of ash on the fan floor to check the drums. After some time, the fly ash was everywhere, much worse than last week.

Saturday, March 8

8:30 a.m.

I went to the Chatham Plant to:

- Close the valves on the baghouse hoppers.
- To obtain samples of the bag which had failed.
- To get the chart from the opacity meter.
- The fly ash had settled around the collection drum on the fan floor but there was too much fly ash around to be able to check inside the drums.
- I will have operators check the drums on Monday before they are emptied.
- I left instructions with the operator on duty to leave the heaters on in the baghouse and to have the air diaphram pump shipped back to Sydney.
- As the sun was coming out, I took some pictures of the baghouse on the roof.
- I left the plant at 9:30 a.m.
- I was back to Head Office by 12:30 p.m. to return test equipment, etc.

Prepared by: M. R. Thanisch

M. R. Thanisch

File: CWF-5 CWF. 4
NRC Burner Test
Baghouse Test

Date: March 12, 1986

REPORT ON MEETING

FOR COAL WATER FUEL BURNER DEVELOPMENT

LOCATION: NRC's Office in Ottawa

DATE: March 12, 1986

TIME: 11:00 a.m. to 4:00 p.m.

SUBJECT: Review of the NRC gun/atomizer and the new No.1 Burner Tests and the Baghouse Test Programs between February 17, 1986 and March 7, 1986.

PEOPLE PRESENT AT MEETING:

Mike Thanisch - NB Power
Adam Bennett - NRC
W. Thayer - NRC
Ed Capes - NRC
Kelly Thambimuthn - EMR- CANMET
Dave Burnett - MBB-Halifax
Bill Pearson - EMR - Coal Division
Kevin Jonasson - NRC
Cliff Adams - EMR - CANMET
Horace Whaley - EMR CANMET/CCPL
Adrian White - CBDC
Phil Read - EMR Coal Policy

DETAILS OF MEETING:

1. Review of Tests - NRC's gun/atomizers - Modifications to Burner No.1 and Baghouse

A. 1st Week of Test Program (February 17 to 21, 1986)

- New sleeve installed in the No.1 burner throat and collars installed around the sleeve dampers on all four burners to improve control of the primary combustion air flow.
- On Wednesday, some burning to set-up the NRC gun/atomizers.
- Unit No.1 out of service Thursday & Friday to repair a vacuum leak in the condensor.
- Some burning until Friday evening.
- The opacity was 40% to 45% with an unsupport coal water flame and two large guns in-service.
- Air flow test of the baghouse.
- Lime coating of the bags in all three baghouses.

B. 2nd Week of Test Program (February 24 to 28, 1986)

- Efficiency testing of two NRC guns under the following conditions:
  1. Two NRC guns burning with air atomizations. Ignitor in burner no.4.
  2. One NRC gun burning CWF with steam atomizations. Second NRC gun with air atomization.
  3. Two NRC guns burning heavy oil with steam atomizations.
- Baghouse tested while burning with CWF with light oil ignitors also in service.
- The first shipment of fuel was burnt by Wednesday evening.
- On Thursday, a hydro test of the new Unit No.3 boiler was started.

C. 3rd Week of Test Program (March 3 to 7, 1986)

- Baghouse test while burning a combination of coal water fuel and heavy fuel oil.
- Burner test - continuous running with both air atomization, and steam atomization while burning CWF.

2. Detailed Discussion

a. Future for the NRC Atomizer Gun:
   - Stand-by atomizer/gun for the Charlottetown CWF test burn.
   - Other application in non-utility boilers.

b. Improvements to burner: After Modifications of the No. 1 burner throat in the Chatham No.1, boiler had been completed which included reshaping the outer burner throat, adding a new inner throat sleeve and swirler, also the primary combination air flow control was improved - this resulted in a much shorter and bushy flame with improved recirculation within the flame. This is the type of flame required for the Charlottetown CWF burn test.

The No.1 burner and the NRC gun gave a good, bright, stable fire. Also this gun/burner arrangement was capable of burning under the following conditions:

1. CWF with air atomization and no support from an ignitor.
2. CWF with steam atomization and no support from an ignitor.
3. Heavy fuel oil with steam atomization and no support from an ignitor.

It should be noted of all the CWF guns tested at Chatham during all the CWF programs this was the only one which would handle steam atomization for a number of hours, this gun/burner ran for 17 hours continuously with steam atomization until the test was discontinued because all the fuel had been burnt.

Copies of the steam flow charts and opacity reading charts that had been recorded during the test programs were presented to the meeting.

c. Fitting an NRC atomizer/gun into the (Cohen) Charlottetown Burners, it was questioned if the gun would be adaptable to the Cohen burner without some modifications to the burner to obtain the required air flow.

d. NRC reported their gun had been demonstrated to have a capacity of 50 to 55 x 10^6 BTU's.

NOTE: The problem with the loss of part of the atomizer tip, prior to the CWF/air atomization test (2nd week) was caused by the use of a thin wall atomizer tip which was being tested, and not the regular thicker ceramics atomizer tip which will not come out the tip holding ring, even if the ceramic parts crack.

e. Where will the next test be conducted?
  - Charlottetown
  - Chatham
  - Sydney Steel
  - a pulp mill boiler

At the present time no plans have been made.

f. There was a great deal of discussion on putting the NRC Atomizer/Gun in the Cohen Burner. Generally it was felt it was expecting too much for the NRC gun to work in the Cohen Burner Register without changes to the air flow.

g. "EMR" do not have the people to develop a burner register to go with the NRC atomizer/gun. They only have Kelly and Horace, and would require a team of about six people to develop a burner register in the required time.

h. A NRC/EMR Burner test (with one gun) could be done in a small industrial boiler (with an air heater) and more than one burner, for example a pulp and paper boiler.

i. Or test just one NRC gun in one of the five burners at Charlottetown.

j. Charlottetown - Schedule

- Baghouse will be installed by June 86.
- Cohen burners company will install their burners in June, 1986.
- The unit must be returned to the original condition, a pressurized boiler by March, 1987.
- The baghouse and I.D. Fan will have to be removed.

k. Fuel to Gun Interaction

NRC had plotted a couple of curves
- one for the CWF delivered to Chatham in the Summer of 1985
- second the first shipment (3 trucks) delivered to Chatham in Feburary 1986, both showing how quickly the viscosity of the fuel dropped.

- part of the same batch of fuel (CWF) is still in storage at the Victoria Junction (fuel preparation plant) and it has not changed in viscosity since it was manufactured.
- the fuel at the Chatham Plant had a rapid reduction in viscosity due to working the fuel, both pumping and passing through the pressure/flow control valves.
- CBDC stated they had no problem with their static storage but they had some problems with the fuel setting up in the their piping on long shut-downs.
- N.B.Power stated they have found it necessary to re-circulate for an hour once a day all the CWF that has been supplied to their Chatham Plant and which was keep in the in-plant storage bunker.
- The reason for this the fuel sets up in the piping (the same as it will in a small can) and settles in the bunker.
- The only fuel that was not recirculated was the three rail cars of CWF held at the plant for 3 months.
- But, after the three months, the fuel settled very rapidly and it was most difficult to remove the fuel from the rail tank cars.

3. Baghouse Test Report (items to be covered)

- Test on bag materials
- Method of operating a baghouse when burning a combination of CWF and Oil.
- The result of the Chatham Baghouse Test.
- Material samples from the bags which failed were shown to the meeting.
- NRC will have a clean sample of this material check to ensure it is the material the supplier said it was.

4. Test At Charlottetown

- NRC gun/atomizer will be a back-up for Charlottetown Cohen burners.
- Some modification may have to be made to the Cohen Burner Register.
- Or a new burner register may be required.
- Can testing of different burners be undertaken at the Charlottetown station?

5. Project Reports

1. One report from NB Power - Vol. I - burners
   - Vol.II - baghouse
2. One report from NRC on their gun development.

A maximum of 12 copies of the report will be required.

6. The reason why good burning was not obtained for the testing during the second week

- By the time the test was finally undertaken the fuel (CWF) had degenerated to the state where it was not stable and would not burn well.

- There had been no change in the moisture content of the fuel but the viscosity had dropped rapidly.
- This drop in viscosity was also noted with the second shipment of fuel during the third week.
- The 'NRC' gun in the No.1 burner was more tolerant of the change in viscosity.
- The 'NRC' gun in the No.4 burner would not handle the change is viscosity and the fire became unstable.

7. Conclusions of Meeting

1. The NRC gun/atomizer worked well, and NRC have applied to have their design pattern.

2. The burner no. 1 modifications worked well and CANMET EMR are thinking of patterning the burner design.

3. Handling of CWF - do not pump and re-circulate the fuel too much.

4. Efficiency tests were conducted under questionable conditions ie., the fuel had degenerated.

5. Testing in an industrial boiler - there is not enough time to undertake this in time to be helpful for the Charlottetown Project.

6. Commissioning of Charlottetown to start in July.

7. CBDC will have the new equipment in their Victoria Junction plant ready to produce fuel in May/June.

8. In the USA all work on CWF development has been cancelled.

9. EMR/CANMET will stay with the project until it is completed.

10. NRC require sufficient lead time if they are to be involved in future atomizer/gun development and testing.

11. If more testing is required at the Chatham Plant, N.B.Power is willing to consider the request.

12. The operators at the Chatham Plant will not be available cecause they are now starting the training for the new No.3 boiler, after which they will be involved in commissioning the new systems. If more testing on Unit No.1 is required, operators will have to be brought in from other Plants.

The meeting closed at 4:00 p.m.

Prepared by

M.R. Thanisch

PILOT BAGHOUSE DEMONSTRATION

AT

N.B. POWER'S CHATHAM T.G. STATION

APPENDIX

SECTION - 16.3

Site Report from MBB, Halifax, N.S.,
dated March 13, 1986.

MBB

M.B.B. Mechanical Services Limited

P O Box 1044, Armdale, Halifax, Nova Scotia B3L 4K9 Phone 902-477-0133 Telex 019-22798

File: C.W.F. 5. Chatham/CHARLOTTETOWN
Coal/Water Burner Development
CHATHAM BAGHOUSE TEST
Date: 5 JUNE 86

05 June 1986

NEW BRUNSWICK ELECTRIC POWER COMMISSION
527 King Street
FREDERICTON, NB
E3B 4X1

Attention: Mr. Michael R. Thanisch, P. Eng.

Dear Mike:

Reference: Chatham Unit #1
Baghouse Test

As per our telecon, enclosed is one (1) copy of the final test report for your records.

Should you require any additional information, please advise.

Yours truly,

MBB MECHANICAL SERVICES LIMITED

David Lawrence

David D.B. Lawrence, P. Eng.

DDBL/eh
Encl.

M.B.B. Mechanical Services Limited
P.O. Box 1044, Armdale, Halifax, Nova Scotia B3L 4K9 Phone 902-477-0133 Telex 019-22798

BAGHOUSE DUST COLLECTOR TEST

Chatham Thermal Plant
March 1986

Prepared by: H. Smith, P. Eng.

13 March 1986

INTRODUCTION

A baghouse dust collector was installed on the roof of the Chatham Thermal Generating Plant to provide a test facility for collecting particulate from the combustion gases of a boiler burning coal/water fuel, and observing actual operating conditions.

The baghouse ID fan was sized to handle approximately 30% of the total combustion gas flow from No. 1 boiler under full load conditions.

The data gathered from the operation of the baghouse at Chatham will be utilized in determining material selection and operating conditions for the baghouse dust collectors at Charlottetown.

EQUIPMENT

The baghouse unit consists of:

* Gas duct from No. 1 boiler breaching to the baghouse
* Three (3) bag modules with ash collection hoppers
* Gas duct from the baghouse to the baghouse ID fan
* Baghouse ID fan
* Gas duct from the baghouse ID fan discharge to No. 1 boiler breaching
* A bag cleaning pulse air manifold and timer on each module

BAG MATERIAL

For the test, bags of different materials were installed in each module:

* No. 1 Module (South) Fiberglass
* No. 2 Module (Centre) Polyester
* No. 3 Module (North) Nomex

COMMISSIONING

The bag cleaning air pulse timers, and pulse air pressures were set to the specifications provided by "CARBORUNDUM":

- * Pulse duration - approx 50 milliseconds
- * Interval between pulses - approx 8 seconds
- * Pulse air pressure - Module No. 1 - 50 psig
  - Module No. 2 - 90 psig
  - Module No. 3 - 90 psig

The baghouse ID fan motor was bumped to check for correct rotation.

The baghouse ID fan was started and operated, drawing clean air through the baghouse, for approximately 1/2 hour to check the fan operation, vibration, heating of bearings, etc. After the 1/2 hour test run of the ID fan, the damper in the inlet duct to the bghouse was closed and powdered limestone was injected into the duct to precoat the bag material (150 lb of limestone).

Differential pressures in inches of water across the bag material was:

	Module No. 1	Module No. 2	Module No. 3
Initial Run	0.2	0.2	0.2
After Precoat	2.0	1.3	1.9

INITIAL TEST RUN

On 24 February 1986, at 1900 hours, No. 1 boiler was operating on coal/water fires only, and the baghouse was put in service. The bag differential pressures were as follows:

DIFFERENTIAL PRESSURES IN INCHES OF WATER

TIME	MODULE NO. 1	MODULE NO. 2	MODULE NO. 3
1900	2.0	1.3	1.9
1915	2.4	1.5	2.2
1930	2.8	1.9	2.5

NOTE: The opacity decreased by 9%, 42% - 33% when the baghouse was put in service.

At 1930, the baghouse was taken out of service, as an oil fire had to be lit to stabilize No. 1 boiler.

At 2000, the coal/water were stabilized and the baghouse was returned to service.

At 2010, the baghouse was taken out of service in preparation for boiler shutdown.

Baghouse differentials at 2010:

MODULE NO. 1	MODULE NO. 2	MODULE NO. 3
3.0	2.0	2.6

A sample of the particulate collected from the bags was collected and analyzed:

Carbon	72.9%
Ash	27.1%
Moisture	1.8%

SECOND TEST RUN

On 25 February 1986, No. 1 unit was on the line to run unit performance tests, while firing coal/water fuel. At 1035, one coal/water fire and one bunker "C" fire, the baghouse was put in service and operated until 1945 under varying conditions, coal/water and oil firing, coal/water - air atomizing, coal/water - steam atomizing, etc.

Following are the baghouse differential pressure readings taken throughout the run:

TIME	MODULE NO. 1	MODULE NO. 2	MODULE NO. 3
1035	3.1	2.2	2.9
1100	3.5	2.3	3.1
1130	3.8	2.6	3.2
1400	4.9	3.6	4.4
1427	5.1	3.9	4.6
1535	5.3	4.0	4.9
1720	5.9	4.7	5.5
1810	6.1	4.9	5.7
1845	6.4	5.2	6.0
1940	6.6	5.4	6.3
Performance tests completed, and the bags were pulsed			
1945	3.7	2.3	2.9

No. 1 unit off the line.

Baghouse running time to date are 9.75 hours.

INSPECTION

On 5 March 1986, inspected the baghouse bags, took photos of the bags (see appendix), pulsed the bags for 10 minutes, then reinspected the bags. All bags were free of ash, and some of the precoat had been lost from the polyester and nomex bags. The baghouse ID fan then started, and 150 lbs of powdered limestone was injected into the baghouse inlet manifold.

NOTE: No. 1 unit was out of service due to a condensor leak - 14 tubes.

Differential pressures across the bags after precoat are as follows:

MODULE NO. 1	MODULE NO. 2	MODULE NO. 3
0.55	0.3	0.6

THIRD TEST RUN

On 6 March 1986, No. 1 unit on the line at 1105, and the baghouse was put in service at 1135. The baghouse differential pressures were monitored, and the bags pulsed as required to maintain the differential pressures below 6" of water. The differential pressure readings are presented in Table No. 1. During the run, velocity profiles were taken on the baghouse outlet ducts, and the main breaching. The results are presented in Table No. 2.

At 2345, the opacity increased approximately 8% for no apparent reason, and it is suspected that the polyester bags ruptured at this time, as pieces of bag material were later found in the ash drum and the differential pressure across the polyester bags did not increase as expected.

No. 1 unit operated through the night (000 to 0300) of 7 March 1986, with two coal/water fires and one bunker "C" oil fire.

At 1030, velocity profiles were taken again on the baghouse outlet ducts, and the main breaching (see Table No. 2). No. 2 module was isolated. At 1310, No. 1 unit was taken off the line, and the baghouse ID fan was shut down.

FINAL INSPECTION

The baghouse module inspection/access doors were opened to inspect the particulate build-up on the bag material. There was approximately 1/4" of particulate build-up on the fiberglass material between the cage rods, very little particulate on the polyester material, and approximately 1/8" of particulate on the nomex material. The doors were reinstalled and the air pulse was put in service. After 1/2 hour of operation, the pulse air was isolated and the bags reinspected. A slight build-up of particulate remained on the fiberglass material, while the nomex material appeared clean. The baghouse ID fan was put in service to check the pressure differential across the bags:

MODULE NO. 1	MODULE NO. 3
2.3	1.6

One of the polyester bags was removed, and samples of the material taken. The material was very brittle, and had very little tensile strength.

CONCLUSIONS

The following conclusions were arrived at after approximately 37 hours of operation of the baghouse under rather extreme conditions, ie. most of the time with at least one oil fire in service.

Polyester Material:

The polyester bags appeared to pass more particulate than the fiberglass or nomex - approximately 1/4 to 1/3 as much particulate collected from the polyester bags. Also, the maximum operating temperature of the polyester material, 300 Deg F, is too close to the airheater, cold end conditions of a utility boiler.

Fiberglass Material:

The fiberglass bags appeared to blind somewhat, high differential pressure across the bags, and a build-up of particulate on the bag surfaces.

Nomex Material:

The nomex bags appeared to provide the better service of the three materials tested, lower pressure differential than the fiberglass, less particulate build-up than the fiberglass and approximately the same quantity of particulate collected from both the fiberglass and nomex.

RECOMMENDATIONS

Although the baghouse test at Chatham is far from conclusive, ie. flows of gas to each module were not matched, the particulate loading in each gas stream was unknown, etc, the bags constructed of nomex material appeared to provide superior performance.

Prepared by: H. Smith, P, Eng.
March 1986

PILOT BAGHOUSE DEMONSTRATION

AT

N.B. POWER'S CHATHAM T.G. STATION

APPENDIX

SECTION - 16.4

Report from R.P.C. in Fredericton, N.B. covering:

The Examination and Testing of The Filter Bag Fabric, dated March 25, 1986.

rpc

research and productivity council
conseil de recherche et de productivité

File: [illegible] Chatham
Coal Water Burner Development
[illegible]
Date: 2 April 86

April 2, 1986 [illegible]

Mr. R. Thanisch
Project Engineering Co-ordinator
515 King Street
Fredericton, N.B.
E3B 4X1

Dear Mr. Thanisch:

Attached are 2 copies of our report of the Examination of the Baghouse Filter Cloth.

Yours truly,

D. Abbott
Head, Applied Sciences

/ja
encl

P.O. Box 6000 Fredericton, New Brunswick, Canada E3B 5H1 • Telephone 506 452-8994 • Telex 014-46115 • Cable Reproduc Fredericton

EXAMINATION OF BAGHOUSE FILTER BAGS FROM N.B. POWER'S CHATHAM UNIT NO. 1 BAGHOUSE

Report Submitted to

Mr. M.R. Thanisch
Project Engineering Co-ordinator
N.B. Electric Power Commission
527 King Street
Fredericton, N.B.

REPORT NO.: AS/86/36
JOB NO.: 50226
DATE: March 25, 1986

C. Ritchie
Chemical Engineer

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1.0 INTRODUCTION

This report is a response to the request made by Mr. M. Thanisch of the N.B. Electric Power Corporation for the examination of two filter bags of different materials from N.B. Power's Chatham Unit No. 1 Baghouse.

The tests requested were as follows:

Test No. 1 Measure the pressure drop across a sample of clean unused material from each bag. Measure the pressure drop across a sample of material that has been in-service and not cleaned from each bag.

Test No. 2 Examine both clean and used samples of material from both bags to determine if oil and ash particles have worked into the filter material and are starting to blind the material.

Test No. 3 Determine if there has been any damage to the material from the heat (about 300°F) of the flue gas passing through the filter bags.

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 King Street
Fredericton, NB
E3B 4X1

1986 03 19

File: CWF - 5
Chatham Baghouse Test

RECEIVED
MAR 24 1986
IDC

Dr. Philip Salib
R.P.C.
P.O. Box 6000
College Hill Road
Fredericton, NB
E3B 5H1

Subject: examination bags that have been in service

Dear Dr. Salib,

Further to our meeting of March 8/1986, would you please under take the following examination of the two filter bags from our Chatham Unit No. 1 baghouse.

Test No. 1 Pressure drop across a sample of clean unused material from each bag.

Pressure drop across a sample of material that has been in-service and not cleaned from each bag.

This test is to determine if the used bags have started to "blind".

Test No. 2 Examination of both clean and used samples of materials from both bags to determine if any oil ash particals have worked down into the filter material and are starting to blind the material.

Test No. 3 Determine if there has been any damage to the material from the heat (about 300°F) of the flue gas passing through the filter bags.

I will enclose copies of the material specification sheets supplied by the bag manufacturer, so that you can see what heat treatment was done to the bags during manufacturing.

The purpose of this examination is to try and determine if one material is superior to the other as filter material for flue gas when burning coal-water fuel (C.W.F.) and fuel oil at the same time.

The purchase order number to cover this work is 060-7288 and the cost ceiling is $1,000.00. The results and a short report should be completed by March 28/86.

The reason for this short time is the results of your examination and the data from our tests at the Chatham Plant will be used to determine which material will be used for the filter bags for the Charlottetown C.W.F. burner test program.

Yours truly,

NEW BRUNSWICK ELECTRIC
POWER COMMISSION

M.R. Thanisch

M. R. THANISCH
PROJECT ENGINEERING
CO-ORDINATOR

MRT:jt

2.0 WORK PERFORMED

The tests were carried out as requested and the results are given below:

Test No. 1 - Pressure Drop

Six inch diameter pieces of filter bag from different spots were tested for pressure drop. Pressure drop was measured with an inclined manometer and air flow was regulated with an appropriate flowmeter.

GIVEN: Flow through baghouse - 5,000 CFM
Number of bags - 70
Bag dimension - 10' long
- 5" diameter

Flow required per square foot.

Surface area of bag $= (5\frac{1}{2} * \pi * 10) + (5/12)^2 * \frac{\pi}{4}$

$= 13.2 \text{ ft}^2$

Flow per ft^2 $= 5000 \frac{\text{ft}^3}{\text{MIN}} /70 * 13.2 \text{ ft}^2$

$= 5.4 \frac{\text{ft}^3}{\text{MIN}} /\text{ft}^2$

Flow required for test apparatus having 6" diameter cross-sectional area.

Flow $= 5.4 \frac{\text{ft}^3}{\text{MIN}} /\text{ft}^2 * (6/12)^2 \frac{\pi}{4} \text{ft}^2$

$= 1.1 \frac{\text{ft}^3}{\text{MIN}}$

It was found that at such low flow rates the pressure drop across the bags were negligible (less than 0.03 inches water).

However, the following tables give the relation between higher flow rates and pressure drops.

FIBER GLASS BAG

Flow/Velocity		Pressure Drop Across Sections Removed From Bag (Inches Water)	
(CFM)	(CFM/FT^2)	5' from Top	Clean
1.7	8.7	0.03	0
3.3	16.8	0.04	0.03
5.0	25.5	0.08	0.03
6.6	33.6	0.18	0.08
8.3	42.3	0.46	0.19

NOMEX

Flow/Velocity		Pressure Drop Across Sections Removed From Bag (Inches Water)		
(CFM)	(CFM/FT^2)	5' from Top	Bottom	Clean
1.7	8.7	0.03	0.03	0.03
3.3	16.8	0.08	0.08	0.08
5.0	25.5	0.26	0.21	0.15
6.6	33.6	0.47	0.33	0.23
8.3	42.3	0.75	0.73	0.45

In conclusion, it was found that with both bags at low flow the difference in pressure drop was almost non-existent, but as the flow rate was increased there was a marked difference in pressure drop between clean and dirty sections.

The Nomex bag was found to offer greater resistance to flow, at higher flow rates, than the fiber glass bag.

Test No. 2 'Blinding' Particles

The dust collected from both bags was examined under microscope and by x-ray diffraction and was found to consist mainly of black material which was presumed to be carbon. Mineral matter is abundant. Most of the dust grains are limestone. Some quartz is also present.

The "dirty" bag fibre was examined under the microscope (Photographs 1 and 2).

Dust and discolouration to the fibre glass woven bag fabric was evenly spread over the surface. There was no evidence of dust penetration below the surface layer. Below the surface layer fibres are free of dust and unstained.

The Nomex material is an unwoven matte of fibres. Discolouration and dust penetration extends in about 1 mm.

A qualitative test was made for the presence of oil on the filter bags. The dirty bag material itself has no oil smell. Bag material was washed with chloroform to dissolve any oil that might be present and the residue examined after the chlororform had evaporated. No oil residue was observed.

It was concluded that no oil was present on the bag fabric.

Test No. 3 Heat Damage

There were no signs of loss of strength or discoloring due to heat.

AUTHORIZATION

DEPARTMENT: APPLIED SCIENCES

PROJECT TITLE: EXAMINATION OF BAGHOUSE FILTER BAGS FROM N.B. POWER'S CHATHAM UNIT NO. 1 BAGHOUSE

PROJECT NUMBER: 50226

PROPOSAL NUMBER

REPORT NUMBER AS/86/36

Prepared By: Charles Ritchie

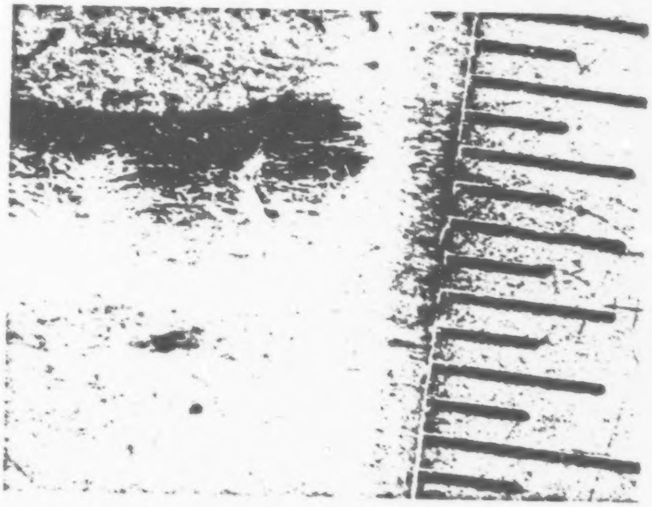
Reviewed By: Philip Salib

Approved By:

Date: March 25, 1986

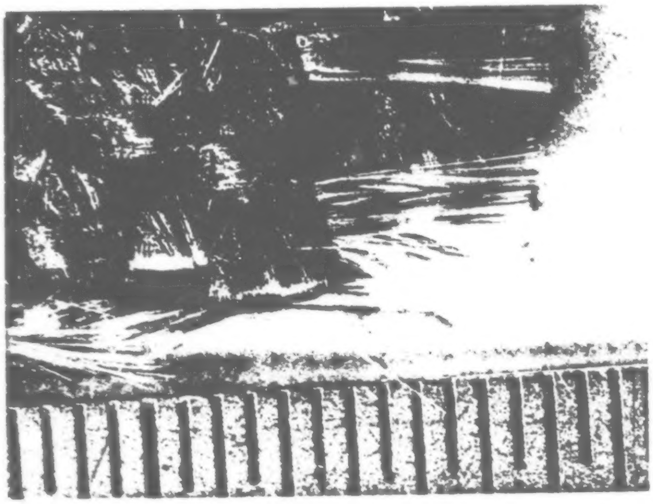
rpc RESEARCH AND PRODUCTIVITY COUNCIL
P.O. Box 6000, Fredericton, New Brunswick, Canada, E3B 5H1
Telephone (506) 452-8994
Telex 014-46115

PHOTOGRAPH 1



Nomex bag, Bag matte fabric is about 3 mm thick
About 1 mm discoloured and penetrated by dust particles.
(1 div. on scale = 0.5 mm)

PHOTOGRAPH 2



Fibre glass woven bag fabric. Outer fibres are discoloured. Dust particles are visible. Note that fibres below the surface layer which were disturbed during cutting are dust free and not discoloured. (1 div. on scale = 0.5 mm)

PILOT BAGHOUSE DEMONSTRATION

AT

N.B. POWER'S CHATHAM T.G. STATION

APPENDIX

SECTION - 16.5

Report from NRC in Ottawa covering:

The Examination of The Filter Bag Fabric
dated April 16, 1986.

National Research Council Canada
Division of Chemistry

Conseil national de recherches Canada
Division de chimie

Ottawa, Canada
K1A 0R6

File: CWF.5.... Chatham/CHARLOTTETOWN
Coal,Water Burner Development
BAGHOUSE CHATHAM
Date: 16 APRIL 86

Section Chemical Engineering

Date April 16, 1986
RECEIVED - 18 APRIL 86

REPORT · RAPPORT

No.

For
Pour
Mr. Mike Thanisch
New Brunswick Electric Power Commission

Subject
Sujet
Optical and Spectroscopic Analysis of Chatham Station Experimental Baghouse Materials

Author
Auteur
K.A. Jonasson

Submitted by
Soumis par ____________________
Section Head Chef de section

Approved by
Approuvé par ____________________
Director Directeur

THIS REPORT MAY NOT BE PUBLISHED IN WHOLE OR IN PART WITHOUT THE WRITTEN CONSENT OF THE NATIONAL RESEARCH COUNCIL

LA REPRODUCTION, MÊME PARTIELLE, DE CE RAPPORT EST INTERDITE SANS AUTORISATION ÉCRITE PRÉALABLE DU CONSEIL NATIONAL DE RECHERCHES

Baghouse samples were each severed from bulk samples forwarded to NRC by NBEPC using a sharp edged scalpel. Several pieces from various parts of each bag were then mounted on glass slides and inspected with the aid of a Bausch & Lomb Stereo Zoom 7 Model BV-1070 microscope. Views deemed representative of the sample were then photographically recorded with the use of a Reichert KAM ES camera system on 3000 ASA Type 107 Polaroid Land Film.

The four samples were:

1. Nomex
2. Polyester
3. Fiberglass
4. Polyester material recovered from the ash hopper.

Observations during sample preparation

1. The Nomex material, a relatively thick felted nylon, was not easily cut by the scalpel.

2. The Nomex seemed to have a heavy layer of dust desposited on its surface was not easily shaken off.

3. The Fiberglass bag had a relatively thin cross section with a loose woven nature.

4. Dust collected on the Fiberglass seemed easily shaken off.

5. The Polyester bag sample was also easily shaken off except in the case of the material that had "broken down" and was found in the ash hopper. This material was found to be extremely friable with particulate material embedded in it.

Sample Preparation

Several approximately 1 cm^2 samples were taken from various points along each bag. These pieces were then mounted on a glass slide using a neoprene adhesive. Three views of each sample were prepared: a pressure side, a back side and an edge view. The pressure side view had the sample positioned with the bag's upstream face normal to the microscope lense and the back view was a reversal of this. The edge view was prepared by fixing the sample on its side thus exposing the severed edge.

Of note is the technique used to cut-out the Fiberglass sample used for the edge view. Due to the Fiberglass' loose woven nature this sample was cut on a 45° angle to the bias of the weave.

Description of photographs

The enclosed photographs were exposed with the Reichert exposure meter set to an ASA of 12. Typical exposures were ¼ to 4 seconds depending on the reflective nature of the surface. A short description of each shot is noted on the backside of the print.

Scaling of the photos is provided. The 1.0 mm scale (smallest demarcations = 0.01 mm) was shot at the magnification used to expose the prints note on the reverse side of the respective scale prints and can be used as a direct scaling tool. Please note that 3 scales are enclosed and are applicable to specific shots. The only shots not scaled are the Nomex edge views. Scale #1 defines only the pressure side and back side shots of the Nomex samples. Scale #2 defines all polyester and fiberglass shots with the exception of the close-up shots of the polyester material found in the ash hopper which are described by Scale #3.

Nomex

The Nomex edge shots show a distinct layer of particulate matter built up on the pressure side of the material. The fly ash is shown to provide a well-developed coating on the pressure side (see pressure side and edge views) but very little penetration of the rest of the material as shown by the edge and back side views. The fibers seemed unaffected by the service conditions.

Polyester

The polyester material, confirmed by spectroscopic analysis as polyethylene terephthalate, (see attached report) was shown to clean easily with no significant development of fly ash in the fiber. Close-up and edge views of the failed material found in the ash hopper seem to indicate the failure may be due to over temperature operation and resultant weakening of the fibers as a fused apperance is apparent.

Fiberglass

The Fiberglass material is shown to be an open woven structure. To be noted, the magnification of the fiberglass prints is the same as the polyester. The Fiberglass material is shown to contain a significantly higher amount of fly ash particulates throughout the weave. This is particularily noticeable in the edge view. Such an observation may be particularily valuable in considering long term blinding.

Photograph Index

1:	Nomex	Pressure Side View
2:	Nomex	Back Side View
3:	Nomex	Edge View
4:	Nomex	Edge View
5:	Polyester	Pressure Side View
6:	Polyester	Back Side View
7:	Polyester	Edge View
8:	Polyester	Edge View
9:	Polyester	Ash Hopper Material Close Up Edge View
10:	Polyester	Ash Hopper Material Close Up Edge View
11:	Polyester	Ash Hopper Material Pressure Side View
12:	Polyester	Ash Hopper Material Edge View
13:	Scale #1	For Nomex Pressure and Back Side Views
14:	Scale #2	For All Polyester and Fiberglass Views Except Ash Hopper Material Close Ups
15:	Scale #3	Polyester Ash Hopper Material Close Ups
16:	Fiberglass	Edge View
17:	Fiberglass	Pressure Side View
18:	Fiberglass	Back Side View

National Research Council
Canada

Division of Chemistry

Analytical Chemistry Section

Conseil national de recherches
Canada

Division de chimie

Section de chimie analytique

No. 19671

To
A
K. Jonasson
Chemical Engineering

Date
April 8/86

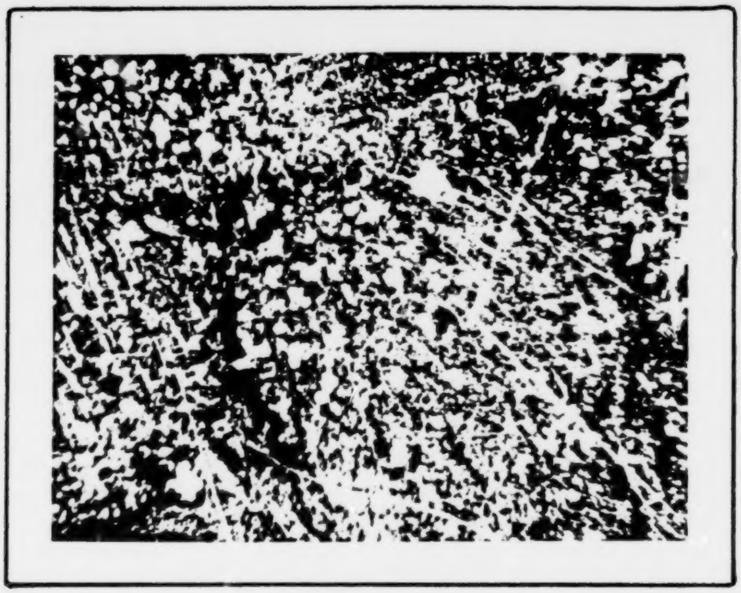
Analysis by
Analysé par G. Gardner

REPORT · RAPPORT

Identification of Filter Material

The sample was examined using infrared spectroscopic techniques. The identity of the material was polyethylene terephthalate ("polyester").

Section No. 1 of Baghouse



Frame 17

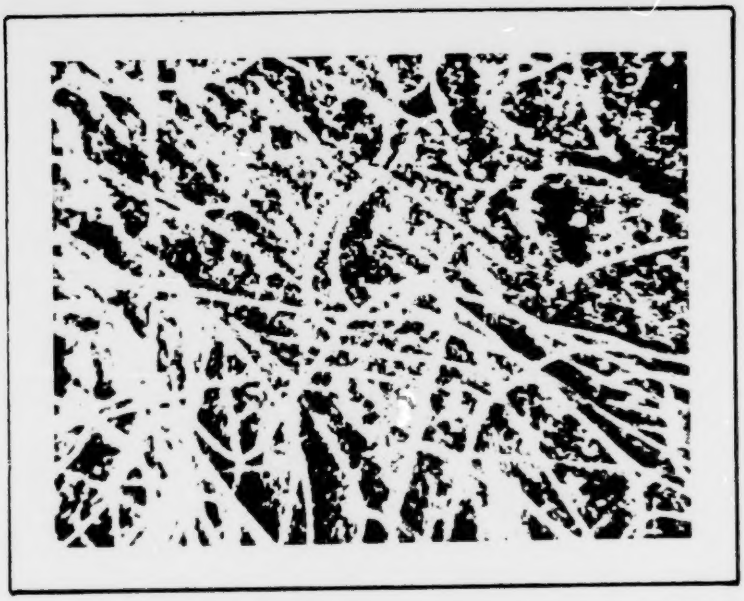
"Fiberglass"
Viewed from the
Pressure Side

Frame 18
"Fiberglass"

Viewed from the
Back Side

Frame 16

"Fiberglass"
Edge View
(Weave Broken
Open)

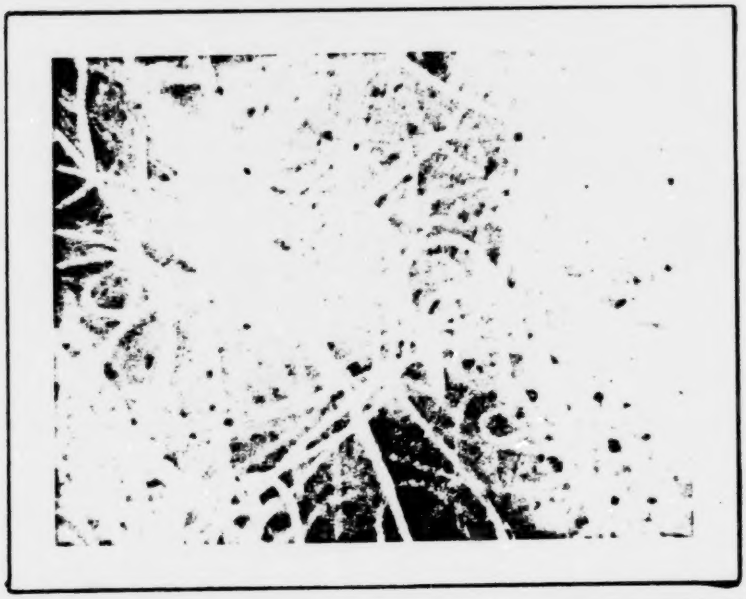


Section No. 2 of

Baghouse

Frame No. 11
"Polyester"

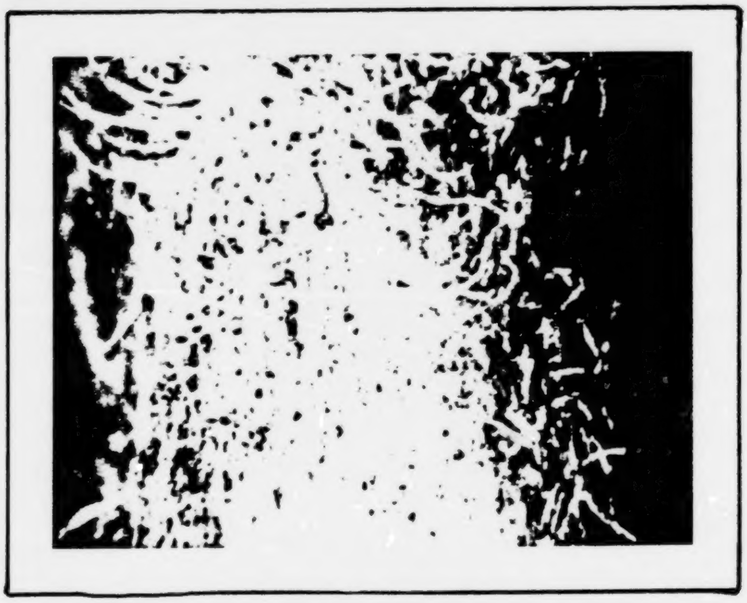
Viewed from the
Pressure Side



Frame No. 6

"Polyester"

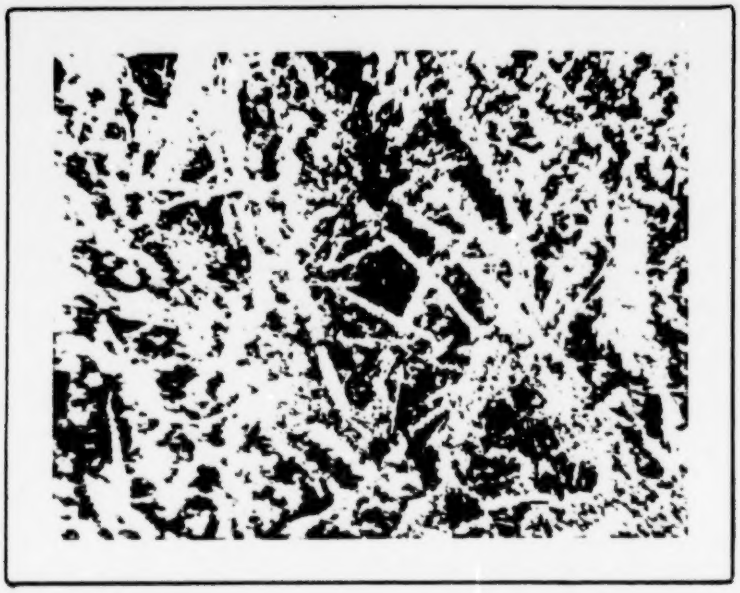
Viewed from the
Back Side



Frame No. 12

"Polyester"

Edge View



Section No. 3 of

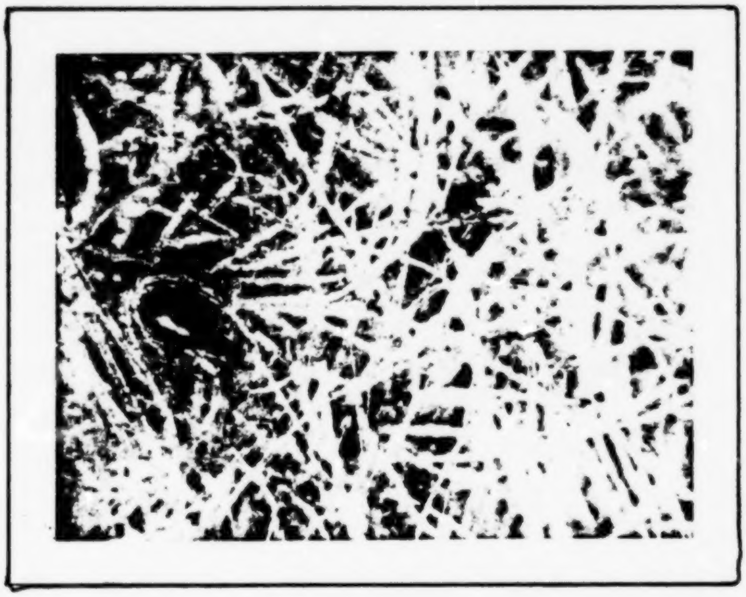
Baghouse

Frame No. 1

"Nomex"

Viewed from the

Pressure Side



Frame No. 2

"Nomex"

View from the

Back Side

Frame No. 3

"Nomex"

Edge View

PILOT BAGHOUSE DEMONSTRATION

AT

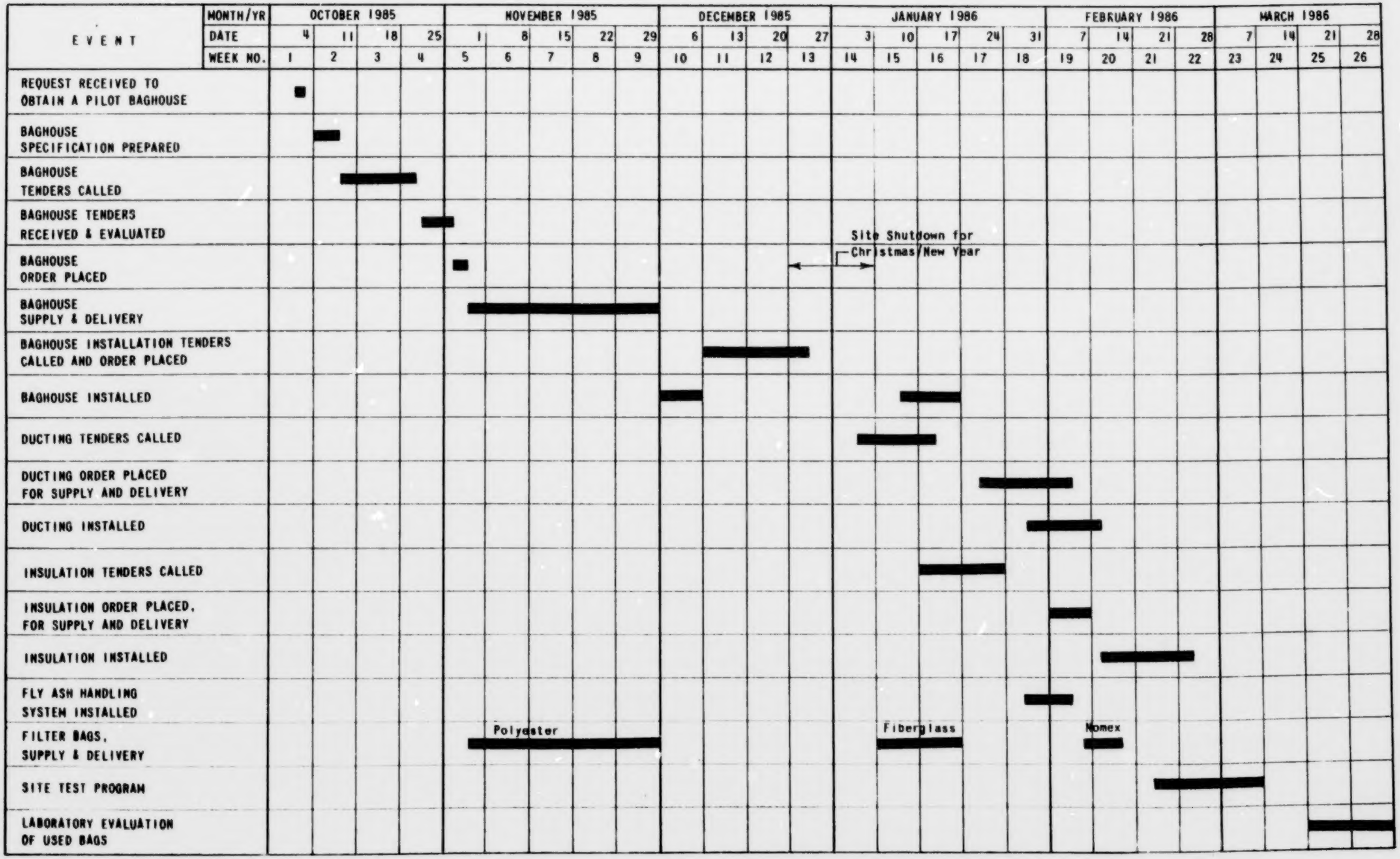
N.B. POWER'S CHATHAM T.G. STATION

APPENDIX

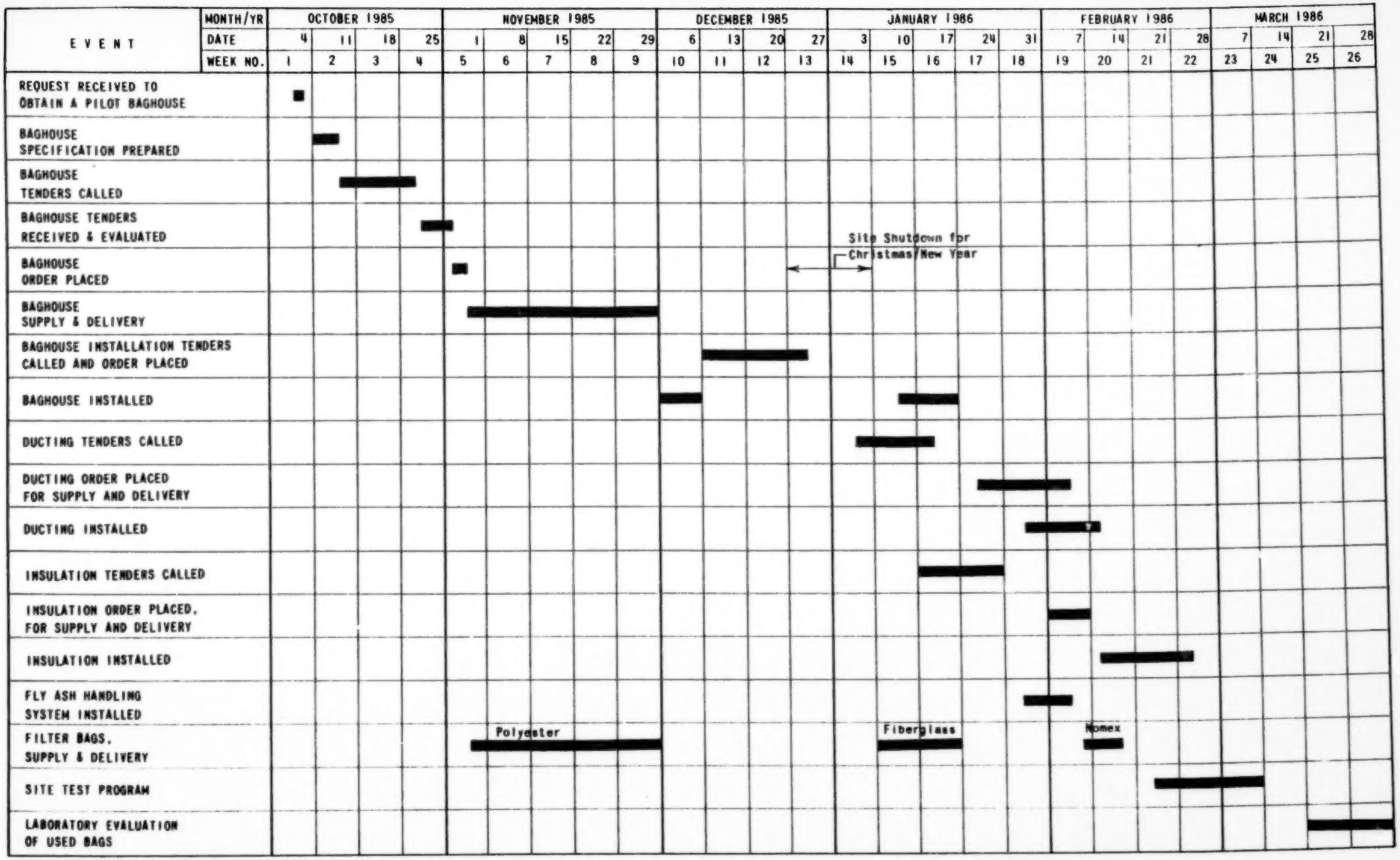
SECTION - 16.6

Project Schedule

PILOT BAGHOUSE DEMONSTRATION
AT N.B. POWER's CHATHAM T.G. STATION
SCHEDULE



PILOT BAGHOUSE DEMONSTRATION
AT N.B. POWER's CHATHAM T.G. STATION
SCHEDULE



PILOT BAGHOUSE DEMONSTRATION

AT

N.B. POWER'S CHATHAM T.G. STATION

APPENDIX

SECTION - 16.7

Major Purchase Orders

1) P.O. 060-8075 - Supply and Transportation of Baghouse
2) P.O. 060-7284 - Additional Set of Filter Bags
3) P.O. 060-7159 - Erection of Baghouse and Support Steel
4) P.O. 060-7176 - Manufacture and Supply of Ducting
5) P.O. 060-7186 - Supply and Installation of Insulation and Cladding
6) P.O. 060-7288 - Examination of Filter Bags which had been in service

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

MATERIAL RECEIVED REPORT NUMBER

RECEIVED FROM SHOW ONLY IF DIFFERENT FROM SUPPLIER UNDER "ORDERED FROM" BELOW

SUPPLIER NAME

ADDRESS

DATE: 86-01-22

PURCHASE ORDER NO / Nº DE COMMANDE: 060-8075

VENDOR NUMBER: 043376

TO/À

Air Correction Canada
282 Belfield Road
Rexdale, ON
M9W 1H5

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

Chatham Generating Station
Lower Water Street
Chatham, NB

ATT M. Thanisch FOR/POUR

F.O.B. POINT-POINT F.A.B.	DELIVERY-LIVRAISON	SHIP VIA-EXPÉDIER PAR	F.S.T.-T.F.V.	TERMS-ÉCHÉANCE
Rexdale	3 weeks approx.	Normal Carrier Prepay & Charge	☐ INCLUDED COMPRISE ☒ NOT INCLUDED NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	

ITEM ARTICLE	DESCRIPTION	OUR STOCK NO	UNIT OF ISSUE	QUANTITY QUANTITE	PRICE - PRIX
	CHARLOTTETWON CWF PROJECT **MATERIAL LIST NUMBER: 673-1000 A** **TEST BAGHOUSE TO BE INSTALLED ON THE CHATHAM UNIT NO. 1 BOILER**				
	For the supply and delivery of:				
1	A baghouse and controls suitable for handling flue gas from coal water fuel and fuel oil burning with a capacity of 15,000 CFM and 210 bags, divided into three sections of 70 bags each.				
2	One set of 70 bags made from Polyester.				
3	One set of 70 bags made from Acrylic.				
4	One set of 70 bags made from Fiberglass.				
5	Fan and motor with a capacity of 15,000 SCFM designed to operate with flue gas at 325°F and 50 HP TEFL motor 575 Volts, 3 phase, 60 cycles.				
6	Isolation dampers on the discharge of each baghouse section.				
	ALL FOR A TOTAL COST OF				

☐ EXEMPT MATERIAL

ADJUSTMENT REQUEST NO

DATE ...f2

QUANTITY TOTAL

PRICE AMOUNT

RECEIVED BY

NO OF PACKAGES		MATERIAL REC'D LOCATION	SOURCE CODE	MATERIAL REC'D & COUNT BY	DATE
☐ PARTIAL SHIPMENT ☐ COMPLETE SHIPMENT	☐ MAIL ☐ EXPRESS ☐ FREIGHT OTHER				

DELIVERING CARRIER

ST	SYS	EXP	S-M	COM	AMOUNT
	020	3	33	1	

EMS	ACCOUNTING DISTRIBUTION MAIN	SUB	COST CENTER	COST CONTROL SOURCE CENTER	ASSET/COMP	TRACKING	AMOUNT	
	673	100	44000	44000				DR
								DR
								DR
								DR
								DR
								CR
H O USE RES AU B C	244	011	21120					

UNIT CODE EXPLANATION

UNIT	ABBR CODE	UNIT	ABBR CODE
CENTIMETRE	CM 01	JAR	JR 44
GRAM	G 02	OUNCE	OZ 46
KILOGRAM	KG 03	PACKAGE	PK 49
LITRE	L 04	PAD	PD 52
METRE	M 05	PAIR	PR 55
MILLIMETRE	MM 06	PIECE	PC 58
MILLILITRE	ML 07	PINT	PT 61
SQUARE MILL	MMP 08	POUND	LB 64
BAG	BG 10	QUART	QT 67
BALL	BL 13	ROLL	RL 70
BOARD FOOT	BF 16	SACK	SK 73
BOOK	BK 19	SET	SE 76
BOTTLE	BT 22	SHEET	SH 79
BOX	BX 25	SPOOL	SP 80
CAN	CN 28	SQ FOOT	SF 82
DOZEN	DZ 31	SQ YARD	SY 85
EACH	EA 34	STICK	ST 88
FOOT	FT 37	TUBE	TU 91
GALLON	GL 40	THOUSAND	M 94
GROSS	GR 41	YARD	YD 97
HUNDRED	C 43		

BUYER ACHETEUR P. J. LaForest 16 PHONE 458-4485

EXPEDITER ORDONNANCIER E. F. Bell PHONE 458-3169

4 MATERIAL RECEIVED REPORT COPY

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

527 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TÉLÉPHONE (506)453-4444 TELEX 014-46194

DATE: 86-01-22

PURCHASE ORDER NO / Nº DE COMMANDE: 060-8075

SHIPPING ADDRESS TERMS AND CONDITIONS ARE AS NOTED ON PAGE ONE
L'ADRESSE D'EXPÉDITION ET LES MODALITÉS SONT MENTIONNÉES À LA PREMIÈRE PAGE

ORDER CHANGE NO. / Nº DE LA MODIFICATION DE COMM.:

TO/À: Air Correction Canada

PAGE NUMBER / Nº DE PAGE: 2 OF/DE 2

ITEM ARTICLE	DESCRIPTION	OUR STOCK NO	UNIT OF ISSUE	QUANTITY QUANTITÉ	TAX TAXE	PRICE PRIX
	TERMS: Net 30 days from date of shipment.					
7	Delivery from Air Corrections' manufacturing plant to the Chatham T.G. Plant in Chatham, N.B. for a total cost of					
	TERMS: Net 7 days on freight.					

TOTAL VALUE OF THIS ORDER:

Baghouse and Fan	$35,000.00
Transportation	2,975.00
TOTAL	$37,975.00

REFERENCE DOCUMENTS:

October 7, 1985	Request for Tenders.
October 8, 1985	Quotation from Air Correction Canada.
October 11, 1985	Confirmation that bags are included in price.
October 23, 1985	Phone call to Air Correction Canada to request the cost for increasing the size of the baghouse to approximately 1/3 full size.
October 28, 1985	Telex quotation received from Air Correction Canada.
October 29, 1985	Phone call to Air Correction Canada to inform them approval had been received from the Charlottetown Project Steering Committee for them (Air Correction) to proceed with the manufacture of the larger baghouse. This was confirmed by telex.
November 21, 1985	Quotation from Air Correction for the cost of shipping.
December 16, 1985	Request (via telex) to Air Correction Canada for detail drawing and operating manual.
December 23, 1985	Terms of Payment.

CONFIRMATION ONLY - ORDER ALREADY ENTERED FOR INTERNAL ACCOUNTING PURPOSES ONLY!

PURCHASE ORDER COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TELEPHONE (506) 453-4444 TELEX 014-46194

SEE REVERSE SIDE FOR INVOICING AND SHIPPING INSTRUCTIONS
VOIR AU VERSO POUR LES INSTRUCTIONS RELATIVES À LA FACTURATION ET À L'EXPÉDITION

DATE: 86-05-07

PURCHASE ORDER NO / N° DE COMMANDE: 060-7284

VENDOR NUMBER: 043376

TO/À
Air Correction Canada Ltd.
282 Belfield Road
Rexdale, Ontario
M9W 1H5
Att: Ron Birley

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
Chatham G.S.
Chatham, NB

ATT M. Thanisch FOR/POUR

F.O.B. POINT-POINT F.A.B	DELIVERY-LIVRAISON	SHIP VIA-EXPÉDIER PAR	F.S.T.-T.F.V.	TERMS-ÉCHÉANCE
Toronto, Ont.	3 weeks		☒ INCLUDED COMPRISE ☐ NOT INCLUDED NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	Net 30 Days

Extra set of Nomex Aramid filter bags for the Chatham Unit No 1 Baghouse $2,240.00/lot

Per your letter of February 27, 1986.

CONFIRMATION ONLY

FEDERAL TAX CODES (IF NO LETTER APPEARS OPPOSITE AN ITEM THE CERTIFICATIONS ARE VOID AND FEDERAL SALES TAX IS APPLICABLE)
A. - WHEN INVOICING PLEASE SHOW AMOUNT OF F.S.T. INCLUDED IN THIS ITEM SEPARATELY
WE CERTIFY THAT THE GOODS ORDERED/IMPORTED HEREBY ARE TO BE USED
B AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT LICENSE NO. B-72216
C. AS OUTLINED IN SECTION 2 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
D. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
E. AS OUTLINED IN SECTION 4 OF PART VI OF SCHEDULE III OF THE EXCISE TAX ACT
F. UNCONDITIONALLY EXEMPT
THE ABOVE FORMAT OF TAX CERTIFICATION APPROVED BY FEDERAL SALES TAX DEPARTMENT

CODES DE TAXE FÉDÉRALE: (SI AUCUNE LETTRE N'EST INSCRITE VIS-A-VIS D'UN ARTICLE LES CERTIFICATIONS SONT ANNULÉES ET LA TAXE FÉDÉRALE SUR LES VENTES DOIT ÊTRE AJOUTÉE)
A. VEUILLEZ INDIQUER SÉPARÉMENT SUR VOTRE FACTURE LE MONTANT DE LA T.F.V. COMPRIS DANS CET ARTICLE
NOUS CERTIFIONS QUE LES MARCHANDISES COMMANDÉES OU IMPORTÉES PAR LES PRESENTES SERVIRONT AUX FINS
B ÉNONCÉES AUX ARTICLES 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE PERMIS N° B-72216
C ÉNONCÉES A L'ARTICLE 2 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
D ÉNONCÉES AUX ARTICLE 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE DE LA LOI SUR LA TAXE D'ACCISE
E ÉNONCÉES A L'ARTICLE 4 DE LA PARTIE VI DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
F. EXEMPTION SANS RÉSERVE
LE TEXTE DES CERTIFICATIONS DE TAXE UTILISE CI-DESSUS EST APPROUVE PAR LE SERVICE DE LA TAXE FÉDÉRALE SUR LES VENTES

ST	BYR	EXP	S-M	COM	AMOUNT
	046	4	33	1	

TEMS	ACCOUNTING DISTRIBUTION			COST CONTROL		
	MAIN	SUB	COST CENTER	SOURCE CENTER	ASSET/COMP	TRACKING
	673	100	44000	43300		
H.O. USE RES. AU B.C.	244	011	21120			

THIS ORDER IS SUBJECT TO ALL TERMS AND CONDITIONS SHOWN ON THE FACE AND REVERSE SIDE HEREOF AND IS NOT SUBJECT TO CHANGE OR MODIFICATION WITHOUT THE PRIOR WRITTEN CONSENT OF THE BUYER
LA PRESENTE COMMANDE DOIT SE CONFORMER A TOUTES LES MODALITES INDIQUEES SUR CETTE PAGE ET AU VERSO ET NE DOIT PAS ETRE CHANGEE OU MODIFIEE SANS OBTENIR AUPARAVANT L'APPROBATION ECRITE DE L'ACHETEUR

AUTHORIZED AUTORISEE
BUYER-ACHETEUR DIR OF PURCHASING-DIR DES ACHATS

BUYER ACHETEUR Anne M. Brown 4 TELEPHONE 458-4478
EXPEDITER ORDONNANCIER R. Miles TELEPHONE 458-3432

1 VENDOR'S COPY - COPIE DU VENDEUR

FORM NO. 9
REV.23/10/74

NEW BRUNSWICK ELECTRIC POWER COMMISSION

PROJECT: CHARLOTTETOWN/CHATHAM DATE: April 25, 1986

MATERIAL LIST NUMBER: 673-1003-A SHEET: 1 OF 1

EXTRA SET OF FILTER BAGS FOR THE CHATHAM UNIT NO. 1 BAGHOUSE

REF. DWG.:

ACCT. DIST'N.: 673-100-44000 ORDER NO.: 060-7284

DRAWN: M. R. THANISCH CHECKED: APPROVED:

ITEM NO.	NO. REQ'D.	DESCRIPTION	PRICE
		CONFIRMATION OF AN ORDER	
		ALREADY PLACED	
		PLEASE PLACE AN ORDER WITH:	
		AIR CORRECTION CANADA LTD.	
		282 BELFIELD ROAD	
		REXDALE, ONTARIO	
		M9W 1H5	
		ATTENTION: MR. RON BIRLEY	
		FOR:	
1	70	NOMEX ARAMID FILTER BAGS	
		FOR CHATHAM UNIT NO. 1 TEST	
		BAGHOUSE - 5 INCHES DIAMETER X	
		10 FEET LONG.	
		AS PER THEIR LETTER DATED	
		FEB. 27/86	
		AT A COST OF $32.00 (CANADIAN) PER BAG	
		F.O.B. TORONTO	
		NET 30 DAY	
		FOR A TOTAL COST OF: $2,240.00	

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION

RECEIVED FROM SHOW ONLY IF DIFFERENT FROM SUPPLIER UNDER ORDERED FROM BELOW

SUPPLIER NAME

ADDRESS

DATE: 6-01-03

PURCHASE ORDER NO / Nº DE COMMANDE: 060-7159

VENDOR NUMBER: 400429

TO/À

Roso Steel Limited
P. O. Box 1140
TRACADIE, New Brunswick

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

Chatham Generating Station
Chatham, New Brunswick

ATT M. Thanisch

FOR/POUR

F.O.B. POINT-POINT F.A.B.	DELIVERY-LIVRAISON	SHIP VIA-EXPÉDIER PAR	F.S.T.-T.F.V.	TERMS-ÉCHÉANCE
			☐ INCLUDED COMPRISE ☐ NOT INCLUDED NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	Net 30 Days

ITEM ARTICLE	DESCRIPTION	OUR STOCK NO.	UNIT OF ISSUE	QUANTITY QUANTITÉ	PRICE
	TEST BAG HOUSE FOR CHATHAM UNIT #1 BOILER				
	Installation of roof stubs, structural beams, bag houses fan unit and roof penetration and re-sealing.				$6,831.00/1
	As per your quotation dated December 13, 1985 signed by Rodolphe Savoie.				7,251

☐ EXEMPT MATERIAL ADJUSTMENT REQUEST NO. DATE QUANTITY TOTAL PRICE AMOUNT

NO. OF PACKAGES RECEIVED BY

☐ PARTIAL SHIPMENT

☐ COMPLETE SHIPMENT

☐ MAIL ☐ EXPRESS ☐ FREIGHT

DELIVERING CARRIER

UNIT CODE EXPLANATION

ITEMS							AMOUNT
	673	100	44000	43300			
	244	011	21120				

Shanks 15 453-4257

Bell 458-3169

5 RECEIVING OFFICE FILE COPY

M & S 832-047

PURCHASE ORDER — COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
515 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TELEPHONE (506) 453-4444 TELEX 014-46194

DATE	PURCHASE ORDER NO N° DE COMMANDE	VENDOR NUMBER
86-02-21	060-7176	532365

SEE REVERSE SIDE FOR INVOICING AND SHIPPING INSTRUCTIONS
VOIR AU VERSO POUR LES INSTRUCTIONS RELATIVES À LA FACTURATION ET À L'EXPÉDITION

TO/À
Sunny Corner Mechanical
Miramichi Industrial Park
Newcastle, NB
E1C 3C4

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
Site
Chatham, NB

ATT. M. Thanisch FOR/POUR

F.O.B. POINT-POINT F.A.B.	DELIVERY-LIVRAISON	SHIP VIA-EXPÉDIER PAR	F.S.T.-T.F.V.	TERMS-ÉCHÉANCE
— Delivered	See Below		☐ INCLUDED COMPRISE ☒ NOT INCLUDED NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	Net 30 days

	CHARLOTTETOWN CWF PROJECT **MATERIAL LIST NUMBER: 673-1002-A** **DUCTING FOR CHATHAM UNIT NO. 1 BAGHOUSE**		
1	The inlet ducting between the existing boiler breeching and the baghouse.	1	
2	The discharge ducting between the baghouse and fan.	1	
3	The ducting between the fan and existing boiler breeching.	1	
	LOT PRICE	D	$4,775.00
	All dimensions are to be field checked at the Chatham Plant before starting manufacture.		
	All ducts are to be made from 11-gauge M.S. Plate and primed with red primer.		
	All connections to existing equipment will be made by N.B. Power with all other joints by Sunny Corner Mechanical Ltd.		
	Delivery: Inlet section within 3 days Remainder within one week.		
	.../2		

FEDERAL TAX CODES: (IF NO LETTER APPEARS OPPOSITE AN ITEM THE CERTIFICATIONS ARE VOID AND FEDERAL SALES TAX IS APPLICABLE)
A. WHEN INVOICING PLEASE SHOW AMOUNT OF F.S.T. INCLUDED IN THIS ITEM SEPARATELY
WE CERTIFY THAT THE GOODS ORDERED/IMPORTED HEREBY ARE TO BE USED
B. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT LICENSE NO. 6-72210
C. AS OUTLINED IN SECTION 2 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
D. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
E. AS OUTLINED IN SECTION 4 OF PART VI OF SCHEDULE III OF THE EXCISE TAX ACT
F. UNCONDITIONALLY EXEMPT
THE ABOVE FORMAT OF TAX CERTIFICATION APPROVED BY FEDERAL SALES TAX DEPARTMENT

CODES DE TAXE FÉDÉRALE: (SI AUCUNE LETTRE N'EST INSCRITE VIS-À-VIS D'UN ARTICLE LES CERTIFICATIONS SONT ANNULÉES ET LA TAXE FÉDÉRALE SUR LES VENTES DOIT ÊTRE AJOUTÉE)
A. VEUILLEZ INDIQUER SÉPARÉMENT SUR VOTRE FACTURE LE MONTANT DE LA T.F.V. COMPRIS DANS CET ARTICLE.
NOUS CERTIFIONS QUE LES MARCHANDISES COMMANDÉES OU IMPORTÉES PAR LES PRÉSENTES SERVIRONT AUX FINS
B. ÉNONCÉES AUX ARTICLES 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE PERMIS N° 6-72210
C. ÉNONCÉES À L'ARTICLE 2 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
D. ÉNONCÉES AUX ARTICLE 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE DE LA LOI SUR LA TAXE D'ACCISE
E. ÉNONCÉES À L'ARTICLE 4 DE LA PARTIE VI DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
F. EXEMPTION SANS RÉSERVE
LE TEXTE DES CERTIFICATIONS DE TAXE UTILISÉ CI-DESSUS EST APPROUVÉ PAR LE SERVICE DE LA TAXE FÉDÉRALE SUR LES VENTES

ST	BYR	EXP	S-M	COM	AMOUNT
	026	4	11	1	

ITEMS	ACCOUNTING DISTRIBUTION			COST CONTROL		
	MAIN	SUB	COST CENTER	SOURCE CENTER	ASSET/COMP	TRACKING
	673	100	44000	43300		
H.O. USE RES AU B.C.	244	011	21120			

THIS ORDER IS SUBJECT TO ALL TERMS AND CONDITIONS SHOWN ON THE FACE AND REVERSE SIDE HEREOF AND IS NOT SUBJECT TO CHANGE OR MODIFICATION WITHOUT THE PRIOR WRITTEN CONSENT OF THE BUYER
LA PRESENTE COMMANDE DOIT SE CONFORMER A TOUTES LES MODALITES INDIQUEES SUR CETTE PAGE ET AU VERSO ET NE DOIT PAS ETRE CHANGEE OU MODIFIEE SANS OBTENIR AUPARAVANT L'APPROBATION ECRITE DE L'ACHETEUR

AUTHORIZED
AUTORISEE
BUYER-ACHETEUR DIR OF PURCHASING-DIR DES ACHATS

BUYER
ACHETEUR J. P. Chessie 16 TELEPHONE 458-4318
EXPEDITER
ORDONNANCIER R. Miles TELEPHONE 458-3432

1 VENDOR'S COPY - COPIE DU VENDEUR

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

527 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TÉLÉPHONE (506)453-4444 TELEX 014-46194

DATE: 86-02-21

PURCHASE ORDER NO. / Nº DE COMMANDE: 060-7176

SHIPPING ADDRESS TERMS AND CONDITIONS ARE AS NOTED ON PAGE ONE
L'ADRESSE D'EXPÉDITION ET LES MODALITÉS SONT MENTIONNÉES À LA PREMIÈRE PAGE

ORDER CHANGE NO. / Nº DE LA MODIFICATION DE COMM.:

TO/À: Sunny Corner Mechanical

PAGE NUMBER / Nº DE PAGE: 2 OF/DE 2

ITEM ARTICLE	DESCRIPTION			QUANTITY QUANTITÉ	TAX TAXE	PRICE PRIX
	All as per the following correspondence: N.B. Power: January 20, 1986 January 21, 1986 Sunny Corner: December 30, 1985 January 16, 1986 Confirmation of telephone order. DO NOT DUPLICATE					

1 VENDOR'S COPY - COPIE DU VENDEUR

M & S 632-042

PURCHASE ORDER — COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TELEPHONE (506) 453-4444 TELEX 014-46194

SEE REVERSE SIDE FOR INVOICING AND SHIPPING INSTRUCTIONS
VOIR AU VERSO POUR LES INSTRUCTIONS RELATIVES À LA FACTURATION ET À L'EXPÉDITION

DATE: 86-02-14

PURCHASE ORDER NO / Nº DE COMMANDE: 060-7186

VENDOR NUMBER: 212503

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
Site
Chatham, NB

TO/À
Guildfords Ltd.
P.O. Box 416
Grandview Industrial Park
Saint John, NB
E2L 4L9

ATT. M. R. Thanisch FOR/POUR

F.O.B. POINT-POINT F.A.B.	DELIVERY-LIVRAISON	SHIP VIA-EXPÉDIER PAR	F.S.T.-T.F.V.	TERMS-ÉCHÉANCE
Destination	2 days from notice		☒ INCLUDED COMPRISE ☐ NOT INCLUDED NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	Net 30 days

CHARLOTTETOWN C.W.F. PROJECT
MATERIAL LIST NUMBER: 673-1001-A
SUPPLY AND INSTALLATION OF INSULATION FOR THE CHATHAM UNIT NO. 1 TEST BAGHOUSE

The supply and installation of:

1 The insulation and cladding for the inlet plenum

2 The insulation and cladding of the baghouse including access doors and air control headers

3 The insulation of the baghouse hoppers

4 Metal enclosure around the baghouse legs, including supports and access door.

All for a total cost of: $6,231.00

All taxex included.

Terms - Net 30 days.

Delivery - Two days from notice to start.

All as per N.B. Power's correspondence:
10 Jan. 86
24 Jan. 86
27 Jan. 86
31 Jan. 86

.../2

FEDERAL TAX CODES: (IF NO LETTER APPEARS OPPOSITE AN ITEM THE CERTIFICATIONS ARE VOID AND FEDERAL SALES TAX IS APPLICABLE)
A. WHEN INVOICING PLEASE SHOW AMOUNT OF F.S.T. INCLUDED IN THIS ITEM SEPARATELY
WE CERTIFY THAT THE GOODS ORDERED/IMPORTED HEREBY ARE TO BE USED
B. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT LICENSE NO. B-72210
C. AS OUTLINED IN SECTION 2 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
D. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
E. AS OUTLINED IN SECTION 4 OF PART VI OF SCHEDULE III OF THE EXCISE TAX ACT
F. UNCONDITIONALLY EXEMPT
THE ABOVE FORMAT OF TAX CERTIFICATION APPROVED BY FEDERAL SALES TAX DEPARTMENT

CODES DE TAXE FÉDÉRALE: (SI AUCUNE LETTRE N'EST INSCRITE VIS-À-VIS D'UN ARTICLE LES CERTIFICATIONS SONT ANNULÉES ET LA TAXE FÉDÉRALE SUR LES VENTES DOIT ÊTRE AJOUTÉE)
A. VEUILLEZ INDIQUER SÉPARÉMENT SUR VOTRE FACTURE LE MONTANT DE LA T.F.V. COMPRIS DANS CET ARTICLE.
NOUS CERTIFIONS QUE LES MARCHANDISES COMMANDÉES OU IMPORTÉES PAR LES PRÉSENTES SERVIRONT AUX FINS
B. ÉNONCÉES AUX ARTICLES 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE PERMIS Nº B-72210
C. ÉNONCÉES À L'ARTICLE 2 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
D. ÉNONCÉES AUX ARTICLE 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE DE LA LOI SUR LA TAXE D'ACCISE
E. ÉNONCÉES À L'ARTICLE 4 DE LA PARTIE VI DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
F. EXEMPTION SANS RÉSERVE
LE TEXTE DES CERTIFICATIONS DE TAXE UTILISÉ CI-DESSUS EST APPROUVÉ PAR LE SERVICE DE LA TAXE FÉDÉRALE SUR LES VENTES

ST	BYR	EXP	S-M	COM	AMOUNT
	046	4	11	1	

ITEMS	ACCOUNTING DISTRIBUTION			COST CONTROL		
	MAIN	SUB	COST CENTER	SOURCE CENTER	ASSET/COMP	TRACKING
	673	100	44000	44000		
H.O. USE RES AU B.C.	244	011	21120			

THIS ORDER IS SUBJECT TO ALL TERMS AND CONDITIONS SHOWN ON THE FACE AND REVERSE SIDE HEREOF AND IS NOT SUBJECT TO CHANGE OR MODIFICATION WITHOUT THE PRIOR WRITTEN CONSENT OF THE BUYER

LA PRESENTE COMMANDE DOIT SE CONFORMER A TOUTES LES MODALITES INDIQUEES SUR CETTE PAGE ET AU VERSO ET NE DOIT PAS ETRE CHANGEE OU MODIFIEE SANS OBTENIR AUPARAVANT L'APPROBATION ECRITE DE L'ACHETEUR

AUTHORIZED AUTORISEE ______ BUYER-ACHETEUR ______ DIR. OF PURCHASING-DIR. DES ACHATS

BUYER ACHETEUR Anne Brown 16 458-4478 TELEPHONE
EXPEDITER ORDONNANCIER R. Miles 458-3432 TELEPHONE

1 VENDOR'S COPY - COPIE DU VENDEUR

ORDER CONTINUATION - CONTINUATION DE COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

527 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TÉLÉPHONE (506)453-4444 TELEX 014-46194

SHIPPING ADDRESS TERMS AND CONDITIONS ARE AS NOTED ON PAGE ONE
L'ADRESSE D'EXPÉDITION ET LES MODALITÉS SONT MENTIONNÉES À LA PREMIÈRE PAGE

DATE: 86-02-14

PURCHASE ORDER NO. / Nº DE COMMANDE: 060-7186

ORDER CHANGE NO. / Nº DE LA MODIFICATION DE COMM.:

PAGE NUMBER / Nº DE PAGE: 2 OF/DE 2

TO/À: Guildfords Ltd.

ITEM ARTICLE	DESCRIPTION			QUANTITY QUANTITÉ	TAX TAXE	PRICE PRIX
	Guildfords' correspondence: 21 Jan. 86 22 Jan. 86 27 Jan. 86 31 Jan. 86 CONFIRMATION ONLY!					

1 VENDOR'S COPY - COPIE DU VENDEUR

PURCHASE ORDER COMMANDE

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK

515 RUE KING STREET, FREDERICTON, N.B., CANADA, E3B 4X1
TELEPHONE (506) 453-4444 TELEX 014-46194

DATE: 86-04-09

PURCHASE ORDER NO / N° DE COMMANDE: 060-7288

SEE REVERSE SIDE FOR INVOICING AND SHIPPING INSTRUCTIONS
VOIR AU VERSO POUR LES INSTRUCTIONS RELATIVES À LA FACTURATION ET À L'EXPÉDITION

VENDOR NUMBER: 474490

TO/À
RPC
PO Box 6000
Fredericton, NB
E3B 5H1

SHIP TO/DESTINATAIRE:
THE NEW BRUNSWICK ELECTRIC POWER COMMISSION
LA COMMISSION D'ÉNERGIE ÉLECTRIQUE DU NOUVEAU-BRUNSWICK
515 King Street
Fredericton, NB

ATT. K.C. Brown FOR/POUR

F.O.B. POINT-POINT F.A.B.	DELIVERY-LIVRAISON	SHIP VIA-EXPÉDIER PAR	F.S.T./T.F.V.	TERMS-ÉCHÉANCE
Destination	N/A		☐ INCLUDED COMPRISE ☒ NOT INCLUDED NON COMPRISE ANY EXEMPTIONS ARE NOTED PER CODES BELOW TOUTES LES EXEMPTIONS SONT INDIQUÉES PAR LES CODES	Net 30 Days

Examination and report on filter bags as per ML 672-1004A — F

CONFIRMATION ONLY

FEDERAL TAX CODES: (IF NO LETTER APPEARS OPPOSITE AN ITEM THE CERTIFICATIONS ARE VOID AND FEDERAL SALES TAX IS APPLICABLE)
A. WHEN INVOICING PLEASE SHOW AMOUNT OF F.S.T. INCLUDED IN THIS ITEM SEPARATELY
WE CERTIFY THAT THE GOODS ORDERED/IMPORTED HEREBY ARE TO BE USED
B. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT LICENSE NO. 8-72216
C. AS OUTLINED IN SECTION 2 OF PART XIII OF SCHEDULE III OF THE EXCISE TAX ACT
D. AS OUTLINED IN SECTION 1, 3 AND 4 OF PART XIV OF SCHEDULE III OF THE EXCISE TAX ACT
E. AS OUTLINED IN SECTION 4 OF PART VI OF SCHEDULE III OF THE EXCISE TAX ACT
F. UNCONDITIONALLY EXEMPT
THE ABOVE FORMAT OF TAX CERTIFICATION APPROVED BY FEDERAL SALES TAX DEPARTMENT

CODES DE TAXE FÉDÉRALE: (SI AUCUNE LETTRE N'EST INSCRITE VIS-À-VIS D'UN ARTICLE LES CERTIFICATIONS SONT ANNULÉES ET LA TAXE FÉDÉRALE SUR LES VENTES DOIT ÊTRE AJOUTÉE)
A. VEUILLEZ INDIQUER SÉPARÉMENT SUR VOTRE FACTURE LE MONTANT DE LA T.F.V. COMPRIS DANS CET ARTICLE.
NOUS CERTIFIONS QUE LES MARCHANDISES COMMANDÉES OU IMPORTÉES PAR LES PRÉSENTES SERVIRONT AUX FINS
B ÉNONCÉES AUX ARTICLES 1, 3 ET 4 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE PERMIS N° 8-72216
C ÉNONCÉES A L'ARTICLE 2 DE LA PARTIE XIII DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
D ÉNONCÉES AUX ARTICLE 1, 3 ET 4 DE LA PARTIE XIV DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
E ÉNONCÉES A L'ARTICLE 4 DE LA PARTIE VI DE L'ANNEXE III DE LA LOI SUR LA TAXE D'ACCISE
F EXEMPTION SANS RÉSERVE
LE TEXTE DES CERTIFICATIONS DE TAXE UTILISÉ CI-DESSUS EST APPROUVÉ PAR LE SERVICE DE LA TAXE FÉDÉRALE SUR LES VENTES

ST	BYR	EXP	S-M	COM	AMOUNT
	046	4	11	1	

ITEMS	ACCOUNTING DISTRIBUTION			COST CONTROL		
	MAIN	SUB	COST CENTER	SOURCE CENTER	ASSET/COMP	TRACKING
	672	208	44000	44000		
H.O. USE RES AU B.C.	244	011	21120			

THIS ORDER IS SUBJECT TO ALL TERMS AND CONDITIONS SHOWN ON THE FACE AND REVERSE SIDE HEREOF AND IS NOT SUBJECT TO CHANGE OR MODIFICATION WITHOUT THE PRIOR WRITTEN CONSENT OF THE BUYER.

LA PRESENTE COMMANDE DOIT SE CONFORMER A TOUTES LES MODALITES INDIQUEES SUR CETTE PAGE ET AU VERSO ET NE DOIT PAS ETRE CHANGEE OU MODIFIEE SANS OBTENIR AUPARAVANT L'APPROBATION ECRITE DE L'ACHETEUR.

AUTHORIZED AUTORISEE
BUYER-ACHETEUR DIR. OF PURCHASING-DIR. DES ACHATS

BUYER ACHETEUR Anne M. Brown 4 TELE 458-4478
EXPEDITER ORDONNANCIER R. Miles TELE 458-3432

1 VENDOR'S COPY - COPIE DU VENDEUR

N.B. POWER
FORM 263 1985-04
M & S 832-040

PURCHASE REQUISITION
(REGULAR)

REQUISITION NUMBER	
location	serial
060	7288

PURPOSE OR USE: NRC Demonstration - Baghouse Test

WHEN RECEIVED ADVISE:

	STREET AND NO.	CITY OR TOWN	ATTENTION
DELIVER TO:	515 King Street	Fredericton	K.C. Brown

ITEM	ITEM DESCRIPTION	STOCK CODE NO.	QUANTITY	PRICE
	Examination & report on filter bags as per ML 1-72-1004B.			
	-Confirmation Only- See Attached Letter			

ITEMS	ACCOUNTING DISTRIB'N.				COST CONTROL		AMOUNT	SUPPLIER AND ADDRESS
	Main	Sub	Cost Centre	Source Centre	Asset/Comp	Tracking		
	672	208	44000	44000	—	—		RPC P.O. Box 6000 Fredericton, N.B.

VENDOR NUMBER:

STATUS:

PURCHASING DEPARTMENT USE ONLY

PROVINCIAL SALES TAX		Items	FEDERAL SALES TAX		Items			Items
0	EXEMPT		A	R.O.A.		E	FUEL OIL	
8	EXTRA		B	III & LIC.		F	N/A	
I	INCLUDED		C	III & SEC. 2		G	TAXABLE 10%	
	AMOUNT SUBJECT	$	D	III SEC.1,3,4		H	TAXABLE 06%	
						I	INCLUDED	

BUYER CODE

EXPEDITER CODE

SUPP. & MAN. CODE

COMMODITY CODE

TERMS AND CONDITIONS OF SALE

F.O.B.	DELIVERY	VIA	F.S.T.	TERMS OF PAYMENT
			☐ INCLUDED ☐ NOT INCLUDED	

REQUESTED BY	DATE	APPROVED-BR.PLANT OR DEPT.HEAD	DATE	APPROVED-DIVISION MANAGER	DATE
1 B Heyman	86-03-25	2		3	
CLEARED-GENERAL STORES	DATE	PURCHASE ORDER AUTHROIZED	DATE	FINALIZED-PURCHASING	DATE
4		5		6	

FORM NO. 9
REV. 23/10/74

NEW BRUNSWICK ELECTRIC POWER COMMISSION

PROJECT: NRC DEMONSTRATION-BAGHOUSE TEST DATE: 1986 03 24

MATERIAL LIST NUMBER: 672-1004 SHEET: ____ OF ____

REF. DWG.:

ACCT. DIST'N.: 672-208-44000 ORDER NO.: 060-7288

DRAWN: K. Brown CHECKED: ____________ APPROVED: ____________

ITEM NO.	NO. REQ'D.	DESCRIPTION	PRICE
		Please place a confirmation order with RPC for the	
		examination and report on filter bags as supplied from	
		the Chatham Generating Station.	
		Requirements are as per letter from M. R. Thanisch to	
		Dr. Philip Salib dated 86-03-19 attached.	
		Report to be submitted no later than March 28, 1986.	
		Cost ceiling $1000.00.	